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THE SOCIOECONOMIC IMPORTANCE OF SHARKS IN THE U.S. FLAG AREAS OF THE WESTERN AND CENTRAL PACIFIC

Prepared by

Mike A. McCoy
and
Dr. Hajime Ishihara
Gillett, Preston and Associates

ADMINISTRATIVE REPORT AR-SWR-99-01

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region

PACIFIC ISLANDS AREA OFFICE

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Explanatory Note

In recent years there has been considerable concern and discussion about whether or not current practices regarding the use of shark resources can be sustained. These discussions have been taking place at the national and international level. At the international level the issue has been the subject of considerable debate, negotiation and more recently international agreements. The 1998 Plan of Action for sharks, emphasizing precautionary principles in fisheries management, was approved by member States of the Food and Agricultural Organization of the United Nations. This agreement, along with the earlier agreed upon Code of Conduct for Responsible Fisheries set forth the general standards for the sustainable use of sharks in commercial fisheries. (See http://www.fao.org/WAICENT/FAOINFO/FISHERY/FISHERY.HTM.) In the United States regulations governing the pelagic fisheries, including sharks, were recently published to rebuild over-exploited shark populations and maintain other stocks at healthy levels for portions of the Atlantic Ocean. In the central, western and South Pacific, where most sharks are taken incidentally in fishing directed at other fish species, there has been considerable public controversy and debate. In contrast to the fisheries in the Atlantic Ocean, the sharks fished in the greatest numbers in the vicinity of Hawaii are oceanic species, predominantly the blue shark, *Prionace glauca*, which has a different life history than many of the coastal species caught in the relevant Atlantic fisheries.

This discussion and controversy has made apparent the pressing need for information about the extent and nature of the use of sharks. Catch data tend to be poor because in the Pacific where sharks predominantly are a bycatch of effort directed at tunas and swordfish and in many longline fisheries there are no requirements for logbooks or observers. Additionally, the trade in shark products, specifically fins, although ubiquitous, is poorly documented. Finally, there are no quantitative assessments of the impact of current exploitation levels on the sustainability of pelagic shark populations.

Almost two years ago, the Pacific Islands Area Office and the Western Pacific Regional Fishery Management Council identified the data and management needs required to address the shark bycatch issue in the relevant pelagic fisheries. It was initially agreed to evaluate the relative size and importance of the trade in shark products within the jurisdiction of the Council. The Pacific Islands Area Office and Council staff developed terms of reference for contractual services that were awarded through a competitive process in August 1998. This report is the results of that initial study.

The report summarizes the information available on the size, extent, and principal participants involved in the utilization of pelagic sharks (and its related trade) and their relative economic importance to the U.S. Pacific Islands. The report documents the extent and magnitude of landings or transhipments through U.S. Insular ports. The consulting firm selected for the work, used staff in Hawaii and Japan, and made site visits to American Samoa, Guam, the Northern Marianas, as well as Chinese Taipei and Hong Kong. Given the limited time and NMFS fiscal resources that were available for the study, this report provides an initial exploration of the subject, highlighting additional information needed to better understand the shark trade at the primary and wholesale levels in the U.S. Pacific Islands and its potential effects on pelagic shark populations. The real benefits of the report are anticipated to lie in its value as a point of departure for a more informed debate on the issue of rational and sustainable shark utilization in the Pacific Ocean.

I would like to thank all of those individuals who took the time to assist in the production of this report, especially the five anonymous reviewers who provided comments and suggestions on the initial draft.

Charles Karnella
Administrator

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SUMMARY OF ISSUES AND MAJOR FINDINGS

Significant configuration differences between fleets that determine relative ability to retain sharks.

Domestic Hawaii longliners utilize ice for the preservation of the catch and many are capacity-constrained. The length of trips as opposed to the short storage life of blue sharks precludes retention of most carcasses. The Korean ultra-low temperature sashimi fleet supplying shark fins that are transshipped through Honolulu target bigeye tuna and freeze their catch. They probably retain only relatively high value short fin mako shark for later transshipment as prices for that species justifies the high transshipment costs.

A majority of Guam-based Taiwanese and Japanese longliners use refrigerated sea water that does not lend itself to the retention of shark carcasses, but Taiwanese vessels contain significant freezer space for storage of bycatch, including some sharks.

Longliners that call in American Samoa are mostly larger Taiwanese vessels that freeze their catch and retain only short fin mako sharks for later transshipment. U.S. purse seiners brine freeze their catch for delivery to canneries. Dried shark fins are the only portion of the incidental catch retained for sale.

Trends in activities of vessels using ports in Hawaii, Guam and American Samoa that influence the volume of sharks or shark products landed.

The number of vessels engaged in the Hawaii longline fishery has been fairly constant. There has been a trend away from targeting swordfish where relatively large numbers of blue sharks are caught, to targeting tuna where deeper set longlines tend to catch fewer sharks.

Port calls at Guam and American Samoa offer an opportunity for vessels to transship or sell shark fins and sharks. Arrivals in Guam by Taiwanese sashimi longliners dropped 30% from 1996 to 1998, while those of Japanese sashimi longliners have increased by 11% during the same period.

Port calls in American Samoa by purse seiners have remained fairly constant during the decade, while the number of calls by industrial longline vessels has dropped about 50%.

Differences in crew and crewing practices that may influence shark finning among fleets.

Domestic Hawaii longliners utilize the fewest crew, many of whom are recent arrivals in Hawaii or Micronesian citizens allowed to work in the U.S.. Crew are paid on the basis of the net returns from the overall catch, with the income from shark fins retained by the crew. Some owners, mostly on owner-operated vessels, retain a share of the proceeds from shark fins for the boat.

Taiwanese longliners in Guam use Indonesian, Chinese and some Filipino crew who are paid a monthly wage and some form of bonus. Shark fin revenue is retained by the owner and shared with Taiwanese crew only. Japanese longliners in Guam employ mostly Filipinos who are also paid a monthly wage. However, crew members are allowed to retain the revenue from shark fins.

U.S. purse seiners employ crew from the Philippines, Pacific Islands, the U.S. and Europe who are paid on a per ton basis of fish delivered to the cannery. During past periods of higher fin prices, greater numbers of crew participated in finning activity. Most finning activity on board now is carried out by those paid the lowest tonnage rates: usually Filipinos and Pacific Islanders.

Taiwanese freezer longliners calling at American Samoa utilize mostly crew from the Peoples Republic of China, however some Filipinos and Pacific Islanders are also employed on two or three year contracts. Most are hired with the understanding that revenue from shark fin sales constitutes their bonus.

Attitudes toward shark finning within the commercial fishing fleets.

Among longline fleets, participants in the Hawaii longline fleet possess the greatest awareness of current conservation concerns regarding sharks. There is a large variation in attitudes within the fleet toward shark finning. Time and effort spent handling sharks for any reason is dependent on the impact on landing and preserving the target species.

Japanese longline vessels in Guam concentrate on landing sashimi-grade tuna but operators allow finning by crew members to augment their income. Taiwanese operators consider the retention of fins and certain more valuable species of sharks as an integral part of their business operation.

Captains and managers of U.S. purse seiners are also highly aware of conservation concerns. Finning is allowed in order to allow mostly lower paid crew to augment their wages.

Shark fin revenue represents the bonus promised crew members working under contract on Taiwanese longline vessels calling at American Samoa. There is an incentive for crews to maximize revenue by finning as many sharks that are caught as possible.

Current status of the worldwide shark fin trade.

Hong Kong remains the center of the worldwide shark fin trade. Most shark fin imported there is processed in mainland China and then sent back to Hong Kong. During the first 11 months of 1998 about 3,500 t of *unprocessed dried* shark fin entered Hong Kong from sources worldwide.

Political reforms in China during the 1980s and the resultant booming economy in mainly southern China, coincided with growing affluence in Hong Kong and elsewhere in Asia. This resulted in a popularization of shark fin soup that had previously been limited to expensive restaurants or for use on special occasions.

Species of shark and fin size, method of preparation, and other factors are important in determining price. Prices that had risen during the late 1980s and were fairly constant during the 1990s declined in late 1997 and are now about 50% of those from peak years. Reasons for the decline include a softening of demand in general and a devaluation of currencies in many shark fin source countries relative to Hong Kong currency and the U.S. dollar.

Importance of the U.S. and Oceania in the world trade of shark fins.

The geographic sources of shark fin imports to Hong Kong are widely dispersed and no one country or area accounted for more than 12% during Jan.-Nov. 1998. The U.S. was the third largest source of *dried* shark fins imported to Hong Kong that year with 286 t recorded.

Hong Kong imported 105 t of *unprocessed dried* shark fins from the countries of Oceania during Jan.-Nov.1998 representing 3.4% of the total imported. Australia was the largest source with 53 t or 50%.

Shark fins off-loaded at Guam by Taiwanese sashimi longliners are landed frozen and shipped back to Taiwan for processing. Fins off-loaded by Japanese sashimi longliners are landed dried and are sold by traders to Hong Kong.

Most shark fin traders in Hawaii, Guam and American Samoa are engaged in other businesses, some unrelated to fishing.

The U.S. mainland shark fin market and Hawaii.

Demographic changes in the U.S. and Canada coupled with restrictions on domestic directed shark fishing appear to have resulted in an increased domestic market for shark fins that cannot be satisfied by U.S. mainland sources. Government import requirements and procedures have made it more difficult to import unprocessed shark fins into the U.S..

Imports of dried shark fin into the U.S. during the decade have dropped from about 275 t in 1992 to about 50 t in 1998. Hawaii is believed to represent an important source of *unprocessed* fins for this market, although no trade or production figures are available. It is unknown how much, if any, of the current imports or Hawaii production sent to North America are processed and exported.

Local markets for shark meat.

Although shark is consumed to some extent in Guam, American Samoa and Hawaii, only the latter has a local commercial market for shark meat. Demand has been small and ex-vessel price low but fairly constant for the past several years.

The role of blue sharks in the shark fin market.

Blue sharks are the most numerous sharks caught in longline fisheries in the western and central Pacific, representing 90% or more of recorded catch. Shark fin dealers and researchers in Hong Kong have estimated that up to 70% of the fins entering Hong Kong trade from sources worldwide are from blue sharks.

A study of Hong Kong traders showed that fins from blue sharks rank lower in desirability than several species of inshore sharks.

U.S. mainland shark fin traders pay more for fins from inshore species such as sandbar, hammerhead, or tiger sharks than those from blue sharks.

Constraints to greater utilization of blue sharks by domestic vessels.

Vessels landing fresh blue sharks in locations where they are utilized for their meat do so within a few days of capture. Operational patterns of Hawaii longline vessels preclude this activity except in some situations such as near the conclusion of a trip.

Vessel configuration, particularly the use of ice rather than freezing for fish preservation, and lack of capacity hinder the Hawaii fleet's ability to retain many sharks for any purpose.

Unlike sashimi-grade tuna or swordfish that can be utilized fresh without further processing, value is added to blue sharks that are freshly caught by further processing. Blue shark products such as surimi are low priced, meaning that ex-vessel prices are correspondingly low. Even if operational and configuration problems were overcome, the low price would make it difficult to employ the additional crew needed to care for sharks landed by longline vessels in Hawaii.

Problems in accurately determining shark fin value and volume.

The complexity of the trade, the variety of species, sizes, grades of shark fin, and lack of available benchmark reference prices make it difficult to assign values to the commodity as a whole.

International trade statistics citing fin value should be used with caution as there can be incentives for shippers to misrepresent value. Volumes can also be misleading as some statistics do not differentiate between fins in various stages of processing that can affect declared weight.

There is a lack of comprehensive data relating to the shark component of catches by all fleets except domestic longliners in Hawaii. Some foreign observer data exists for Taiwanese and Japanese sashimi longliners, but represents a very small sample and must be used with caution.

Little work has been done in the central and western Pacific on developing species-specific conversion factors for converting the number of sharks caught to live or dressed weight, or determining weight of fins as a percentage of body weight, or *wet* to *dried* fins for commercially important species.

Shark fin volume and value in Hawaii, Guam and American Samoa.

A snapshot representing volume and value in 1998 is given from known or assumed factors derived from traders and those knowledgeable in the industry.

Hawaii has the best available catch data of all areas and fleets surveyed. An estimated 38 t of *dried* shark fins with an ex-vessel value of about $1 million was produced in 1998, about 95% of which came from blue sharks.

Data covering the volume of fins transshipped through Honolulu from Korean ultra-low temperature high-seas longline vessels are not available, however from known activities it is estimated at 132 t with a value of $2.4 to $2.6 million.

Wet fins transshipped through Guam from Taiwanese sashimi longliners represent 5 to 6 t dry weight equivalent, with a value of from $100,000 to $180,000. *Dry* fins landed by Japanese sashimi longliners in Guam are estimated at 18 to 28 t and valued at $180,000 to $364,000.

Taiwanese longliners are thought to produce more fins than are landed in American Samoa. The volume landed is estimated to be from 35 to 47 t with an ex-vessel value of $455,000 to $705,000.

U.S. purse seiners are believed to have landed approximately 9 to 10 t of *dried* fins in American Samoa worth $162,000 to $230,000 ex-vessel.

Importance of shark fin income to fishing vessel crews.

Fishing vessel crews are the main recipients of revenue from the ex-vessel sale of shark fins in all fleets except Taiwanese longliners in Guam.

Both wages and income from the sale of shark fins received by individual crew members on domestic Hawaii longliners are significantly greater than those received by crew members on Korean, Taiwanese and Japanese longline vessels.

The contribution of shark fin revenue as a percentage of crew member compensation is greatest in the Taiwan ultra-low temperature/albacore longline fleet off-loading in American Samoa and the Japanese sashimi longline fleet offloading in Guam. It is least on U.S. purse seiners.

Economic contribution of shark and shark fin sales to island economies.

The calculation of economic contribution includes crew spending, shark meat sales, local transshipment expenses, trader gross margin and direct government revenue.

Although the ex-vessel value of shark fins produced in or transshipped through Hawaii, Guam and American Samoa in 1998 was from $4,223,000 to $5,259,000, the total annual economic contribution was less because of little benefit accruing from the large volume of fins transshipped through Hawaii.

The total direct economic contribution to all three areas in 1998 is estimated to have been from $2.4 million to $3.2 million. Hawaii received roughly 61%, American Samoa 25%, and Guam 14% of the total.

Cultural importance of sharks in Hawaii and American Samoa.

Published sources indicate that in Hawaii a shark could be an *'aumakua* –a beneficent guardian spirit, a family protector, a fishing helper–or an *'unihipili*–a spirit that would do the bidding, for ill or for good, of its sorcerer-caretaker.

Of 34 species of sharks listed by biologists for Hawaii, one author believes that the nine Hawaiian names known indicate some deep sea species might have been unknown or that some names previously used are now lost.

In general, currently known names for sharks in Hawaii and American Samoa refer to coastal rather than pelagic species.

Both Hawaiians and Samoans undertook offshore fishing expeditions for the express purpose of capturing large sharks for food. However, the importance of sharks as a non-commercial food source in Samoa is much more evident in historical and contemporary accounts than those from Hawaii.

In Samoa, these expeditions and the accompanying ceremonial distribution of sharks at their conclusions were undertaken up until the 1950s.

There does not appear to be any spiritual relationship in American Samoa similar to the *'aumakua* in Hawaii.

Issues to consider in the imposition of management measures.

Only a few domestic vessels would be affected by the imposition of management measures in Guam and American Samoa, mostly in the latter.

A Pacific Island Area Fishing Agreement with Taiwanese longliners would be unlikely in any island Exclusive Economic Zone that imposed anti-finning measures. Although the Japanese longliners might be more pragmatic and consider such restrictions, their government may object on issues of fisheries management principles or trade.

It is not clear that retention of the status quo may result in more sharks finned in Hawaii. Shifts in target species, and crew demographics may play a role. However, based on past practice it is possible that the percentage of sharks finned will increase if prices rise and a shift towards targeting tuna continues.

A prohibition on finning would greatly reduce the amount of fins produced by domestic vessels in Hawaii as only sharks from the last few sets would most likely be

retained. The incentive to retain blue sharks would probably be less than that to retain marketable short fin mako and thresher sharks.

Allowing fins to be possessed but requiring them to be in proportion to carcasses that must also be retained will require some research to determine the applicable conversion factors. It would require increased monitoring and weighing of both fins and carcasses at the time of landing. This could cause problems when numerous vessels off-load at one time.

Requiring the carcass to be landed for each set of fins reduces monitoring tasks but still would require a degree of checking at the time of landing.

Any requirement to retain a carcass whole would preclude filleting at sea. This would eliminate any future efforts to more efficiently store sharks onboard or better market certain shark species through improved handling and freezing on board, should vessels be equipped to do so.

Imposition of a per trip weight limit for shark fins would also require development of appropriate conversion factors and a degree of monitoring. The different targets of swordfish and tuna may complicate the calculation of fin weight limits on a per trip basis.

Little work has been done in attempting to develop fishing gear that might reduce incidental shark catch. Consideration should be given to investigating mitigation measures and to applying gear technology skills to this problem in longline fisheries.

There is an undetermined amount of shark finning activity by other vessels such as those engaged in bottomfishing in Hawaii that may be affected by any management measures adopted.

2. INTRODUCTION

The revitalization of the longline fishery in Hawaii during the late 1980s and early 1990s brought new entrants into the fishery from both coasts of the United States. As participation increased, landings of swordfish and tuna reached nearly 9,000 t by 1991 when a moratorium on further new entrants was put into place. As the fi9shery expanded and then matured, increased interest by scientists, administrators, and the public at large began to focus on species caught incidentally in the fishery. Several scientific projects initiated and carried out by the NMFS Southwest Fishery Center's Honolulu Laboratory addressed the shark portion of the incidental catch, including the disposition of sharks in the longline fishery.

The practice of "finning," the removal of the economically important fins from a shark and the discarding of the carcass, became more of an issue as the decade progressed and each year a greater proportion of the shark bycatch was finned. In response to calls to consider prohibiting the practice, the Pelagics Plan Team suggested in 1996 that it was important not only to understand the scale of the problem and attempt to ascertain the scale of impacts on the shark population but also to understand the impact on fishermen of removing this source of revenue (WPRFMC, 1999).

Discussions between the NMFS Pacific Islands Area Office and staff of the Western Pacific Regional Fishery Management Council subsequently resulted in an approach to better understand the important socioeconomic considerations of sharks in the fishery in general. In addition, it was agreed that since little information on the subject existed from Guam, the Northern Mariana Islands, and American Samoa, any investigations should include these areas as well as Hawaii.

A concept document that focused on the socioeconomic aspects of shark bycatch in the western Pacific fisheries and associated management implications was produced.[1] This document was later expanded into a project proposal for funding and administration by NMFS. Subsequent to publication of a request for proposals, NMFS selected and contracted a consultant to provide a report on the subject. This report is the result of these efforts to better understand the importance of sharks in these fisheries from a socioeconomic perspective, and to provide information that will assist in determining implications of potential management alternatives.

The report is not intended to be an all-encompassing look at the subject of sharks. In particular, specific biological information relating to sharks as well as details of the shark catch in the Hawaii-based fishery are not included. For the latter, the reader is directed to the quarterly summaries of data from Western Pacific longline logbooks as well as the summaries of data generated by NMFS observers summaries. These are provided to the Western Pacific Regional Fishery Management Council by the NMFS Honolulu laboratory on a quarterly basis. Details of the biology and life history of sharks prevalent in the fisheries covered in this report are available in numerous publications, both scientific and popular.

The report is organized so that the reader can first gain some familiarity with the vessels involved in the fisheries covered in the study. In Hawaii the focus is on the longline fishery that targets both swordfish and tuna. In Guam discussion centers on the foreign longline fleets that

[1] Minutes of the 97th Western Pacific Regional Fishery Management Council Meeting, July 27-29, 1998.

utilize the commercial port for transshipment and in American Samoa both the foreign longline fleet and the U.S. purse seine fleet are surveyed. Sharks are caught incidentally by each of these fleets. The current practices and attitudes toward sharks among the various fleets are then reviewed, and a summary of estimates of landings and the disposition of sharks and shark by-products are given. The importance of income from shark fin sales to vessel crews is followed by an assessment of the direct economic contribution attributable to sharks in the economies of Hawaii, Guam, and American Samoa. Although not a major focus of the study, the cultural role played by sharks is also surveyed to assist in better understanding some current public perceptions. Several management alternatives are identified and discussed so that potential impacts associated with curtailing or prohibiting the landing of sharks or shark products can be estimated.

Between December 1998 and April 1999, more than 140 people were contacted and interviewed in Honolulu, the U.S. mainland, Tokyo, Hong Kong, Taipei, Kaohsiung, Guam, Saipan, and American Samoa. This number includes 27 vessel owners or their agents; 24 captains or crew; 15 shark fin dealers or processors; 16 vessel or shipping agents; 12 representatives of Fishing Associations; and 27 government officials, as well as members of academia, non-governmental organizations (NGOs), fishery observers, suppliers and other individuals familiar with the subject matter.

Much of the information in the section on attitudes of owners, captains, and crew was collected during on-site interviews at various fishing ports in Taiwan, Japan, Hawaii, Guam and American Samoa. Given the geographic range covered in the project, the large number of people directly involved in the fishing industry, and the limitations of time and available funds, it was considered impractical to attempt the collection of information through such means as the circulation of a questionnaire. Persons available for interviews were thus determined by which vessels were in port at the time of the consultant's visit. Owners or owners' agents interviewed were those who either weren't preoccupied with other business at the time or who were generally disposed to talk to the consultant about their business activities. Captains and current crew members were interviewed after approval of the owner or owner's agent was sought and obtained. Since some owners weren't disposed to talk about the subject and obviously didn't want their captain or crew discussing it either, it cannot be said that these comments completely represent the various fleets and industry segments identified.

In the case of Hawaii, because of the lack of homogeneity in the fleet, an attempt was made to interview owners, captains, and crew from vessels representative of the several types, as defined by vessel size and target species. However, publicity given the issue of finning during the course of the project made obtaining such information difficult.[2] Some owners, usually sensitive about describing the manner in which they conduct their business in any case, were even more reluctant to discuss the issue of shark incidental catch once the subject became publicly debated.

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[2] Publicity was given to the issue of shark capture and finning by longline vessels in Hawaii from television and print news reports in January 1999 of a particular shipment of fins from high-seas vessels that was identified as being conducted without proper permits. At about the same time legislation that would effectively restrict shark finning was introduced in the State legislature and news reports covered this as well.

The authors also encountered constraints in data availability due to government regulations of confidentiality, as well as a general unwillingness by those in the private sector to divulge information because of the competitive nature of the business.

Throughout this document, metric units of measurement are used unless otherwise specified. All currency values are in U.S. dollars unless expressly described otherwise. The term bycatch, unless otherwise noted, such as its use within the context of the Magnuson-Stevens Fishery Conservation and Management Act, is meant in its most general sense, i.e. species caught incidentally to the target species. Abbreviations found in the report are as follows:

CIF	Cost, Insurance and Freight
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FOC	Flag of Convenience
FRP	Fiberglass-reinforced plastic
FSM	Federated States of Micronesia
FY	Fiscal Year
grt	gross registered tons
hp	horsepower
kg	kilogram
kl	kiloliter(s)
kts	knots
m	meter(s)
PIAFA	Pacific Island Area Fishing Agreement
NT$	New Taiwan dollar
NTOU	National Taiwan Ocean University
PRC	Peoples Republic of China
RSW	refrigerated sea water
SPC	Secretariat of the Pacific Community
t	metric ton
ULT	ultra low temperature

The common names used for sharks are those used by FAO and cited in Rose (1996) as follows:

Prionace glauca	blue shark
Carcharhinus longimanus	oceanic whitetip shark
Carcharhinus falciformis	silky shark
Isurus oxyrinchus	shortfin mako shark
Carcharhinus plumbeus	sandbar shark
Carcharhinus obscurus	dusky shark
Galeocerdo cuvier	tiger shark

The three species of thresher shark: *Alopias pelagicus* (pelagic thresher shark), *Alopias superciliosus* (bigeye thresher shark), and *Alopias vulpinus* (thresher shark) are referred to collectively as threshers, since little distinction is made in published statistics or by fishermen in most instances. Likewise, hammerhead sharks, *Sphyrna lewini* (scalloped hammerhead), *Sphyrna*

mokarran (great hammerhead) and *Sphyrna zygaena* (smooth hammerhead) are also grouped together and referred to as hammerheads.

The authors would like to thank all of those who were willing to spend the time to discuss a difficult and sometimes cryptic subject and to acknowledge the assistance of Mr. Gordon Yamasaki of NMFS in American Samoa, Ms. Dot Harris of the Guam Department of Commerce, Mr. Oliver Seth of Sea Pak Guam, Dr. Toru Taniuchi and Mr. Kuniaki Takahashi in Tokyo, Mr. Edwin Fong in Hong Kong, Mr. Peter Ho of the Overseas Fisheries Development Council in Taipei, Dr. George Chen of the National Taiwan Ocean University in Keelung, Mr. Charles Lee and Mr. Kevin Lin of the Taiwan Deepsea Tuna Boatowners and Exporters Association in Kaohsiung, Mr. Tim Lawson of the South Pacific Community in Noumea, and Mr. Tim Park of the Micronesian Maritime Authority in Pohnpei. The assistance of Mr. Joe Arceneaux, an NMFS employee with extensive experience and first-hand knowledge of the Honolulu-based longline fishery, was invaluable in helping to better understand the attitudes of fishermen in Hawaii and the activities of the longline fleet there.

3. OVERVIEW OF RELEVANT FLEET CHARACTERISTICS

A basic understanding of the fleets involved from each of the locations surveyed here is important to understanding the importance of sharks to those fleets. Vessels engaged in the fishing activities covered by this report do not target sharks as part of their fishing strategy; rather, they capture sharks incidentally to operations targeting tuna and in the case of some vessels in Hawaii, swordfish.[3]

3.1 Hawaii Longline Vessels

Vessels engaged in the Hawaii longline fishery are an eclectic group, utilizing versatile hull designs and deck configurations from other fisheries such as shrimp trawling or salmon purse seining[4]. During most of this decade they could be generally described by their major target fishery: swordfish or tuna. However, that distinction has blurred somewhat as vessels that primarily targeted swordfish switch to targeting tuna during certain seasons in response to changes in the markets for these species.

There is no comprehensive data base from which to draw detailed descriptions of the fleet as a whole, but a general description of vessel size and age for 1993 can be found in Ito et al. (in prep.). Following earlier Management Council categories, Hamilton et al. (1996)[5] categorized the fleet in 1993 as consisting of three class sizes: small, medium, and large, with the largest being over 22.5 meters (74 ft) and the smallest under 17 meters (56 ft). Although it is recognized that changes have occurred within the fleet over the past 5 years, most larger vessels have been engaged primarily in the swordfish fishery because their size allows greater capacity for extended trips as well as operation in the generally rougher waters north of Hawaii.

Perhaps the most important characteristic of all vessels irrespective of target species is the utilization of ice to preserve the catch. Longliners operating from Hawaii must use ice because of the market demand for fresh and not frozen fish. The larger vessels have fish holds divided into bins, with 2 to 2.5 tons capacity per bin. An undetermined number of the larger vessels have ice makers installed on board. For these vessels, the fish hold is fully filled with ice prior to departure and the ice maker used to make up for melting during trips that can last 30 to 45 days or longer.

Significant differences in fishing practices are characterized by the surface sets of the swordfish longliners using monofilament leaders, 2.1 or 2.0 mm in diameter, and the deeper water sets of the longliners targeting tuna that employ a hydraulic line shooter and generally use stainless wire leaders.[6]

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[3] Some fishermen on some purse seiners are reported to set one or two individual "shark lines" at night while drifting and waiting for the next day's operations.

[4] A description of the changes in composition of the Hawaii longline fleet and the reasons for those changes can be found in Travis (1999).

[5] The study by Hamilton, et al. (1996) representing information for 1993 is currently the only available "snapshot" describing the Hawaii longline fleet in economic and operational terms.

[6] This is in contrast to large Japanese high-seas longliners and many larger Taiwanese vessels targeting bigeye who have switched from wire to monofilament leaders because of perceived better catch rates with the latter.

In general, while activity takes place both inside and outside the 200-mile EEZ around Hawaii, vessels often travel relatively great distances from Hawaii to engage in fishing operations. Greater distances on average are traveled to the first set of the trip by vessels making swordfish trips, while the shortest distances traveled to the first set are by vessels making tuna trips. In 1997 vessels engaged in swordfish fishing traveled an average of 623 miles before making their first set, while vessels engaged in tuna fishing traveled 288 miles. Those engaged in trips with mixed targets traveled an average of 365 miles before making their first set (Anon, 1998).

Although a limited-entry regime exists in the fishery with 164 licenses issued, only about two-thirds of the permitted vessels are actively engaged in the fishery full time. There is also a size limitation on boats, with 30.5 meters (100 ft) being the maximum length vessel allowed.

There is no current demographic information on crew aboard longliners in Hawaii. Fishermen employed in the fleet are Caucasian, Korean, Japanese, Vietnamese, Hawaiian, and those from other Pacific islands. Of the latter, most are non-U.S. citizens from Pohnpei in the Federated States of Micronesia who are allowed to work in the U.S. under terms of the Compact of Free Association between the U.S. and FSM. Using Hamilton's estimates from 1993 and the current number of vessels active, it is estimated that there are about 450 fishermen employed in the Hawaii-based longline fishery.

Hawaii longline vessels are either owner-operated or a part of small, generally family-run businesses with one up to five or more vessels[7]. There has been no current survey to determine the number of hired captains and owner-operators in the fleet; however, in 1993 owner-operators predominated in the tuna and mixed targeting vessels, while swordfish targeting vessels appeared to have the highest percentage of hired captains.

There are various methods of calculating crew compensation, but all are based on the sale of the vessel's catch on a per trip basis. Crew shares often vary according to experience or tasks aboard the vessel. Aboard some vessels, certain operations costs are deducted from the gross sales proceeds, and the crew's share of the vessel's catch is calculated after deductions are made for such items as fuel, bait, lost fishing gear, and ice. Some captains or owners claim that shark fin revenue for the crew can be an important supplement to their share money, particularly when fishing, or prices, or both are poor.

3.2 High-Seas Longline Vessels Transshipping Shark Fins Through Hawaii

The transshipment of shark fins through Hawaii to Asia from vessels fishing on the high seas has been undertaken for most of this decade (M. Lau, pers. commun.). The trade involves the capture of sharks as bycatch by longliners targeting bigeye tuna in the central Pacific and tankers that service those longliners and provide fuel, provisions, and a market for the fins.[8] Local Hawaii-based longline vessels are hired on a casual basis by the traders to provide

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[7]The term family-run as used here and in discussing fleets of some other nationalities distinguishes smaller operators from large, conglomerate-style or vertically integrated corporate businesses that tend to dominate fisheries utilizing larger ships such as factory trawlers.

[8] Shipping agents engaged in supporting the supply business confirmed this arrangement in written testimony sent to State Senate committees in late March and April 1999.

transportation for the fins from tankers located beyond the 200-mile EEZ to Honolulu where they are off-loaded into standard 20 or 40 ft shipping containers for shipment to Asia.

Although high-seas longline vessels from Japan, Korea, and Taiwan operate in the central and eastern Pacific targeting bigeye and yellowfin for the sashimi markets,[9] the Korean vessels are apparently the main ones contributing to the Hawaii shark fin transshipment trade. Reasons for this are not completely clear. It may be that the area of Japanese high-seas fishing operations are generally farther to the east and southeast of Hawaii closer to South America and French Polynesia. This, coupled with established transportation and supply patterns, may be the main reasons for a lack of reliance on Hawaii by Japanese vessels for transshipment of fins.[10]

Taiwanese vessels that predominantly target albacore in the North Pacific during a portion of the year currently do not transship fins through Hawaii since these vessels usually return to American Samoa, Fiji, or Tahiti to off-load or transship their catch and may obtain a better price in those ports than from buyers on the high seas.[11]

Korean longline vessels targeted mainly albacore in the past, basing in American Samoa, Fiji and Vanuatu. The Korean fleet expanded rapidly during the late 1960s so that by 1974 there were 270 vessels fishing in the Pacific, primarily for albacore (Park et al., 1991). According to Reipen (1987), when longlining for albacore slumped due to lower prices in the 1970s, some Korean longliners began targeting tuna for the sashimi market using second-hand Japanese vessels that could freeze and store sashimi-grade tuna at very low temperatures.

Longline vessels fishing so far from the major sashimi markets began to freeze their catch for transfer at sea or in foreign ports to special refrigerated carrier vessels ("reefers") that service the fleets. Since the temperature at which the catch is held is around -50°C, the vessels are sometimes referred to as ultra-low temperature, or ULT, longliners and reefer carriers. The reefer carriers also provide frozen bait and other supplies to the longliners in the fishery. By the late 1980s, the Korean fleet had almost completely switched to targeting sashimi-grade tuna for the Japanese market using ULT longliners.

During the 1990's Korea developed an alternative domestic market for sashimi tuna that used approximately 13,000 t of sashimi-grade tuna annually by 1996 (Lee, 1998). This new market was developed by four major fishing companies who owned a combined total of 480 sashimi restaurants during that year, and who also own an undetermined number of vessels in the Korean high seas fleet.

The Korean ULT fleet worldwide now numbers around 200 vessels according to the Korea Deep Sea Fisheries Association. The operations of these estimated 200 vessels can extend beyond the Pacific to areas in the Indian and Atlantic Oceans, depending on fishing conditions

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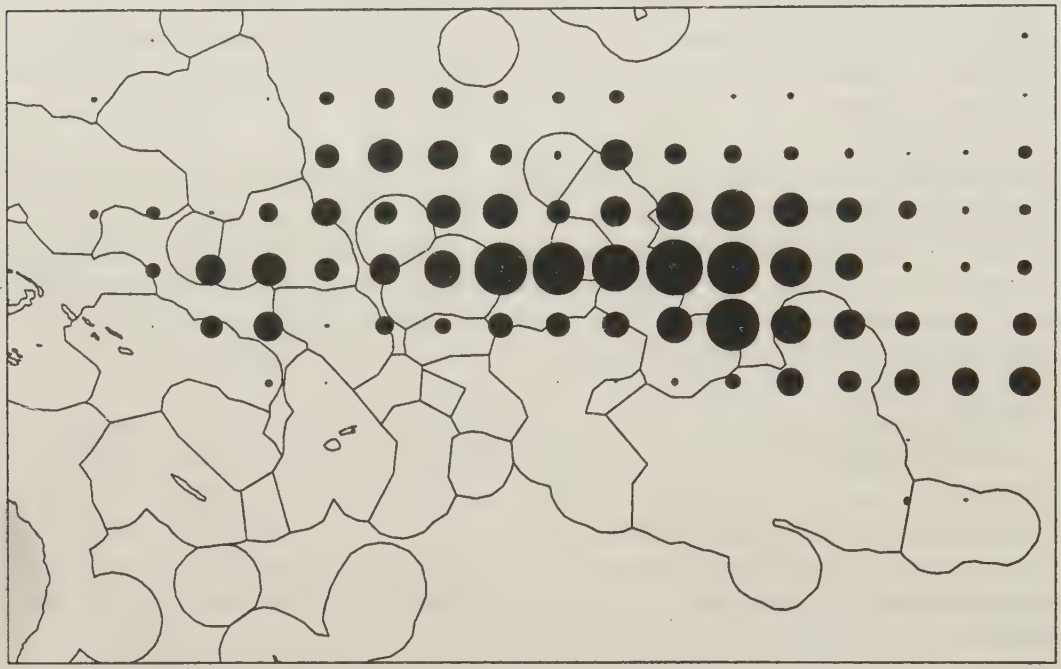
[9] Significant Taiwanese effort is also directed at albacore as discussed later in this section.

[10] An official of the Federation of Japan Tuna Fishery Cooperative Associations stated that he believed fins are sold to Japan-based refrigerated transport vessels that pick up catch from vessels in port and on the high seas (Y. Harada, pers. commun.).

[11] Some of the smaller Taiwanese longliners apparently do sell fins on an opportunistic basis on the high seas when it is necessary to meet tankers and obtain fuel. However, high seas refueling does not appear to be a usual part of their general operating pattern due to their limited storage capacity and resultant trip lengths averaging from 2 to 4 months.

and other factors. In 1997 there were 135 such vessels operating in the Pacific, 13 in the Atlantic, and 52 in the Indian Ocean (Lightfoot and Friberg, 1998). Industry sources indicate a shift of some vessels into the central Pacific in 1998 has increased the number active to over 150 or more in early 1999 (J. Kim, pers. commun.). This fleet targets bigeye and yellowfin in an area stretching from northern French Polynesia westward to the Gilbert Islands of Kiribati. Although operations shift from year to year to take into account oceanographic factors and resource availability, Figure 1 below taken from 1993 data is representative of the general operating area for this fleet in proximity to Hawaii.[12] Indications are that in subsequent years the fleet has operated as far east as longitude 80°W off the coast of South America (Park, 1998b).

Figure 1. Korean distant-water longline effort, 1993



Source: Oceanic Fisheries Program, SPC

Compared to other longline fleets in the central and western Pacific, there has been relatively little detail published on the catch of the Korean ULT fleet. The long periods spent at sea and relatively small reliance on EEZs of countries with advanced management regimes have meant that no observers from the regional SPC South Pacific Regional Tuna Resource Assessment and Monitoring Project have been placed aboard Korean high-seas longliners in the central Pacific (Williams, 1996). The Korean government does not operate a formal observer program, but has carried out "irregular-onboard scientific trips" since 1991. Three trips have been taken on board Korean longline vessels since 1991, each lasting a total of 2 months (Park, 1998a).

[12] Figure 1 shows relative effort for 1993 by 5° square. Although the amount of effort may vary from year to year, the area covered is a good indication of the overall range of the fleet. The Island of Hawaii is visible along the upper edge of the figure that represents 20° N. latitude.

Korean ULT vessels registered on the Forum Fisheries Agency's Regional Register in 1997 averaged 456 grt (Gillett and McCoy, 1997). Specifications for a typical vessel are shown in Table 1.

Table 1. Specifications of a typical Korean ULT distant water sashimi longliner

Year constructed	1985
Length (m)	49
Breadth (m)	8.7
Depth (m)	3.8
Draft (m)	3.4
Hold capacity (t)	280
Main engine (hp)	1,000
Speed (kts)	11.5
Fuel consumption (kl/day)	2.5
Total crew	25

Source: Sajo Industries, cited in Lightfoot and Friberg (1998)

While the vessels may nominally be home-ported in Pusan, they reportedly stay at sea for long periods of up to 6 or 8 months or more, obtaining fuel and supplies from tankers and transshipping their catch on the high seas or at island locations that are convenient and relatively free from the scrutiny of government officials.[13] They return to Korea only once every 2 to 3 years for major refit or repair.

Many of the Korean ULT vessels are owned by large fishing or food processing companies in Korea. A period of building new vessels occurred in the late 1980s as older vessels were replaced with larger, more efficient ones. However, there reportedly have been no new vessels built since 1991 (Lightfoot and Friberg, 1998).

3.3 Foreign Longline Vessels Off-loading at Guam

There are two distinct groups of foreign longline vessels operating from Guam. The Japanese group consists of mainly small (under 20 grt) fiberglass vessels from Okinawa or the southern main islands of Japan. The second fleet is comprised of fiberglass Taiwanese vessels, of mainly two size classes: the first is roughly equivalent to the Japanese vessels in overall size, capacity, and horsepower, while the second is somewhat larger. Table 2 describes the major characteristics of these fleets.

Both the Japanese and Taiwanese fleets target sashimi quality bigeye and yellowfin tunas that are transshipped by air to Japan. Graham (in prep.) has pointed out important differences in bycatch rates among the fleets,[14] with the Taiwanese vessels tending to capture a

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[13] American Samoa has been used in the past for some transshipping; however, there appears to be a general reluctance for vessels to enter U.S. ports because of the age and condition of some vessels and the desire of owners to avoid increasingly stringent U.S. Coast Guard requirements.

[14] While the citation is for longline vessels based in Palau, the vessels are from essentially the same fleets as those based in Guam and fish in the same general areas of the W. Pacific.

greater percentage of both sharks and billfish than the Japanese. Work undertaken by the Oceanic Fisheries Program of the South Pacific Community (Lawson 1997a) used observer data to interpret and refine reported catch data of the Taiwanese and Japanese fleets operating in the western Pacific, many of which are based in Guam from time to time. Preliminary results indicate that the percentage of sharks (by estimated weight) in bycatch of Taiwanese offshore longliners is on the order of 3.75 times greater than that by Japanese longliners. SPC notes that these results need to be treated with some caution, as the observer coverage in both fleets has not been large and may not adequately cover some incidental species of bycatch. Nevertheless, the results point to what those in the industry understand and accept: that Taiwanese do catch more sharks, that they make greater use of bycatch, and are more financially dependent upon sharks as a component of that bycatch.

Table 2. Characteristics of Guam-based foreign longline vessels

Characteristic	Japan <20 gross ton class	Taiwan CT-3 class	Taiwan CT-4 class
Hull material	FRP	FRP	FRP
Gross tonnage	14-19	30-40	40-50
Main engine hp	250-450	200-400	250-550
Longline main line material	kuronawa (roughly half of vessels) monofilament (roughly half of vessels)	monofilament	monofilament
Main fish preservation method	RSW	RSW	RSW
Main bait species used	saury, mackerel, sardine	Squid, some live milkfish	Squid, some live milkfish
Fresh fish capacity	20-24 t	18-24 t	24-30 t
Frozen fish capacity	Negligible	12-15 t	15-20 t
Total number crew	7-9	6-7	8-10
Nationality of officers	Japan	Taiwan	Taiwan
Nationality of crew	Philippines; some Indonesians	Indonesian, some PRC	Indonesian, some PRC

3.3.1 Japanese Longline Vessels

Some of the Japanese longline vessels that transship their catch in Guam via air freight to Japan also operate from time to time out of ports in the Federated States of Micronesia and Palau. All are owned by family-run small businesses in Japan that rarely exceed two or three such vessels. In some cases vessels are owner operated. Vessels of this size were based in Japan during the 1970s and through the mid 1980s, operating in coastal Japanese waters as well as into the FSM, Palau and some high-seas areas of the western Pacific. In the late 1980s some began basing operations out of Guam and FSM, transshipping their tuna catch in Guam for air shipment to Japan. This practice has continued to a varying degree during the decade. In January,

1999 approximately 50-60 such vessels were based in Guam.[15] Vessels tend to remain in the western Pacific region for up to 2 years or more, returning to Japan only for periodic major refits and drydocking.

A vessel agent interviewed in Guam claimed about 50% of the vessels use Japanese-style tarred synthetic line, "kuronawa", that is coiled into a storage bin behind the wheelhouse. The other half of the fleet were said to use monofilament and a Japanese spooling system rather than a US-style longline reel.[16] A few of the vessels calling at Guam for transshipment of their catch to Japan by air are the larger 59 gross ton class vessels, all of which use kuronawa. In the past, hook leaders or "gangions" employed in the fishery were exclusively made of wire. However, from talking to those knowledgeable it appears that most, if not all, vessels now use monofilament leaders. Almost all the vessels employ refrigerated sea water (RSW) for initial cooling and holding of the catch. The few that are not fitted with RSW systems use ice.

Vessels average trips of from 14 to 20 days, depending on the distance to fishing grounds, usually in the Federated States of Micronesia or the high-seas areas to the south. Catches can range from 2 t to 15 t.

During the 1970s and early 1980s when operations were based in Japan, these vessels employed only Japanese crew. However, as operating costs rose and it became more difficult to attract Japanese labor into the fishery, recruitment of foreign nationals became prevalent during the late 1980s and into the 1990s. This shift to foreign crew coincided with movement of vessels to Guam and the development of transshipment activities there. The vessels typically now have only one or two Japanese nationals (a captain and sometimes engineer), while the rest of the crew are recruited mainly from the Philippines and Indonesia.

The vessels were initially designed to carry a maximum of five crew; however, according to captains and vessel agents in Guam the number of crew is increased to seven to nine when employing Filipinos or Indonesians because of their lower productivity. Living conditions are thus very cramped, with only the relatively short trip lengths making it more bearable.

Crew compensation has apparently been somewhat reduced since 1997 with the Asian economic crisis resulting in the increased valuation of the dollar against both the peso and rupiah. Whereas Filipinos could be expected to receive $360 per month on Guam-based boats two years ago (Gillett and McCoy, 1997), the going rates for new crew in 1999 were said to be around $300 or so.[17] Increases in wages are reportedly given after the successful completion of a one-year contract and subsequent renewal. Typically, crew are not paid these wages directly but rather most of the money is sent back to agents in their home country for dispersal to families and to pay agents' fees.

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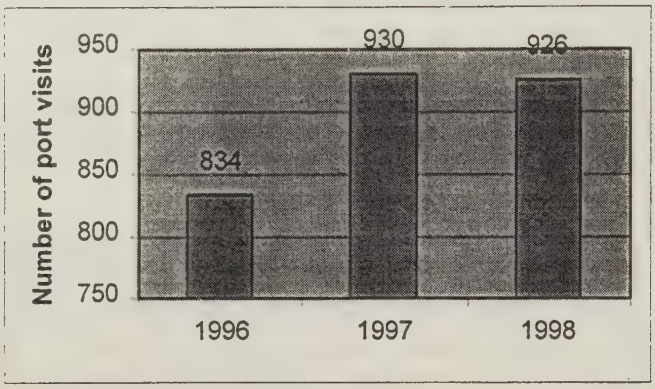
[15] This number includes a few larger vessels of up to 60 grt. It fluctuates as some vessels return to Japan for periodic maintenance, occasionally offload in the Federated States of Micronesia, or quit or rejoin the fishery.

[16] The only available source of detailed information, the FFA Regional Register, does not detail the material of the main line, so it is not usually possible to validate this claim. Inspection of seven Japanese longline vessels at Apra harbor in February 1999 showed six were fitted with kuronawa and only one with monofilament.

[17] Crew wages were sometimes spoken in the context of "wages plus bonus." However, it was not possible to determine what kind(s) of bonus system might be used as further incentive to crew.

The Japanese fleet has increased the number of port calls in Guam over the last 3 years by about 11%. Reasons for this are not completely clear, as available records do not identify the size of vessel. One reason may be an increased use of the port by larger vessels, those in the 59 gross ton class that in the past have delivered their catch directly to Japan. However, it may also be that the increase in number is at least partially due to a retrenchment of transshipment activity by vessels operating elsewhere, such as in FSM or Palau, due to high costs of transshipping in those locations. Figure 2 depicts the increase in port calls to Guam by Japanese vessels by fiscal year (October- September).

Figure 2. Number of port calls at Guam by Japanese longliners during Fiscal Years 1996-1998



Source: Guam Harbormaster's Office

3.3.2 Taiwanese Longline Vessels

The Taiwanese vessels that deliver fresh sashimi-grade tuna to Guam for transshipment to Japan are mostly from ports in southern Taiwan. In January 1999 there were approximately 35 vessels operating out of Guam.[18] The overall number of vessels in the Taiwanese fleet is estimated to be over 200, with vessels also operating from time to time from ports in the Federated States of Micronesia, Palau, Philippines, the Republic of the Marshall Islands, Bali, and other ports in Indonesia. Like the Japanese vessels, they are mostly family owned and, according to one vessel agent in Guam, about 10% of the vessels are owner-operated. For a majority of the fleet (up to 80% of the vessels operating in the region) the captain owns a share of the vessel. About 10% of the vessels are operated by a hired captain.

Vessels typically arrive in Guam from Taiwan and stay for 6 to 9 months before returning for repair, crew rest or other reasons. Technically classified by Taiwan's government as coastal vessels and not overseas-based ships, the requirements for returning to Taiwan are more stringent than for larger longliners delivering to such ports as American Samoa. As with the Japanese vessels, trips last from two to three weeks, sometimes longer depending on the location of fishing grounds and fishing conditions. Agents in Guam indicated that approximately

[18] Vessel agents ascribed the small number of vessels to two factors: it was the off-season in the western Pacific region, and high license costs in FSM had driven vessels to base out of Bali, Philippines and elsewhere.

90% of the fleet utilizing Guam as a transshipment port employ RSW systems to chill and hold the catch. The remaining vessels use ice.

The biggest physical differences between Taiwanese and Japanese longliners in Guam are the Taiwanese ability and interest in carrying a far greater amount of frozen bycatch on board than the Japanese. This is driven by the market in Taiwan for bycatch species, initially a fresh market satisfied by coastal vessels fishing in relative proximity to Taiwan, but now also filled by frozen bycatch from vessels based overseas.

According to one agent with extensive experience in the western Pacific fishery, a Taiwanese longliner operating for a 12-month period in the western Pacific based in Guam could be expected to catch and sell roughly 60 metric tons of tuna (both sashimi grade exported to Japan and some rejects sold locally in Guam), and 30 metric tons of frozen bycatch, including sharks. Those shark species that are retained include silky and oceanic white tips. Shortfin makos are relatively rare, but are also retained. Blue sharks are discarded. All retained sharks are finned, as are most sharks that are discarded because they have little or no commercial value. Fins are placed in sacks and frozen and stored on board. Most bycatch as well as the frozen fins are either taken back to Taiwan by the vessel or shipped via container if the vessel plans to remain in Guam beyond the time when its freezer hold spaces are full.

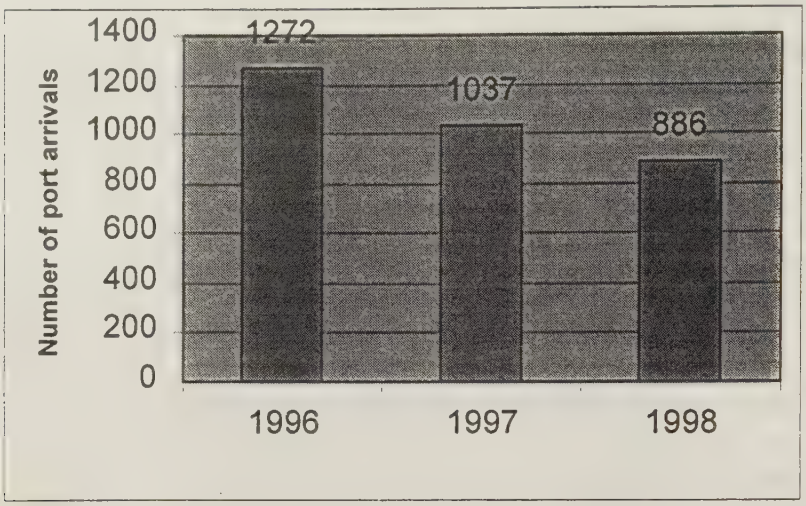
Crews are made up of two, three, or four Taiwanese, with the remainder being either Indonesian or mainland Chinese. Most Chinese crew members are recruited from Fujian province in the People's Republic of China. The wages paid are said to be about the same or a little less than those paid to crew from the Philippines for work aboard Japanese vessels, with $300 per month used as the benchmark figure for wages. As with Japanese vessels, there is most likely a bonus system employed by the Taiwanese to further encourage work; however detailed information was not available.

Although crewing with Chinese could be seen as better for linguistic and cultural reasons, vessel agents remarked that recent immigration problems in Guam involving a few Taiwanese vessels and illegal mainland Chinese immigrants in Guam have resulted in more scrutiny for those vessels employing Chinese. There thus appears to be some preference for employing the relatively experienced Indonesian crew in spite of potential communication problems. There are also direct flights between Guam and Bali, a large longline port in its own right, that facilitates recruiting.

The total number of port arrivals for all Taiwanese longline vessels has averaged 1,065 from October 1995 to September 1998. Although there are seasonal variations in the numbers of vessels that might call at Guam to offload, there has been a continuous downward trend in the number of vessel arrivals. From FY 1996 to FY 1998 the total drop has been 30% as is shown in Figure 3. In January 1999 vessel agents reported that the trend had intensified since October 1998, although figures were not available.[19]

[19] Reasons for a decline in visits are directly related to fishing opportunities other than FSM or Palau and a shift of vessels away from those two areas because of low catch, high access fees, increased transshipping costs, or a combination of all factors.

Figure 3. Number of port calls at Guam by Taiwan longliners during Fiscal Years 1996-1998



Source: Guam Harbormaster's Office

3.4 Industrial Fishing Vessels Off-loading in American Samoa

Both purse seine and longline vessels off-load in American Samoa. The purse seiners are almost exclusively U.S. flag vessels with carrying capacities of 800 to approximately 1,300 metric tons. With the exception of four older Korean longliners of about 200 gross tons based in 9American Samoa and one or two Tongan vessels, the foreign longliners that off-load there are all Taiwanese.[20]

3.4.1 Purse Seine Vessels Landing in American Samoa

U.S. purse seine vessels are able to fish in a wide area of the central and western Pacific under licenses issued pursuant to the treaty between the US and FFA member countries. Most fishing takes place in a 20-degree band of latitude centered on the equator, from 130° E. to 150° W. longitude. The target species of skipjack and yellowfin tuna are frozen in brine and stored in freezer wells on board. At the end of calendar year 1998 there were 39 US flag purse seine vessels licensed under provisions of the tuna treaty with the US, although about 35 actually operated. This number has decreased from 47 vessels in 1995.

About one-third of the vessels are owned by U.S. canneries, while the rest are owned by mainly family-operated enterprises.[21] A recent trend is towards greater cannery ownership of vessels within the fleet. Crew are mostly non-U.S. citizens, with several nationalities represented. Crews are paid on the basis of the tonnage of fish caught, usually irrespective of vessel expenses.

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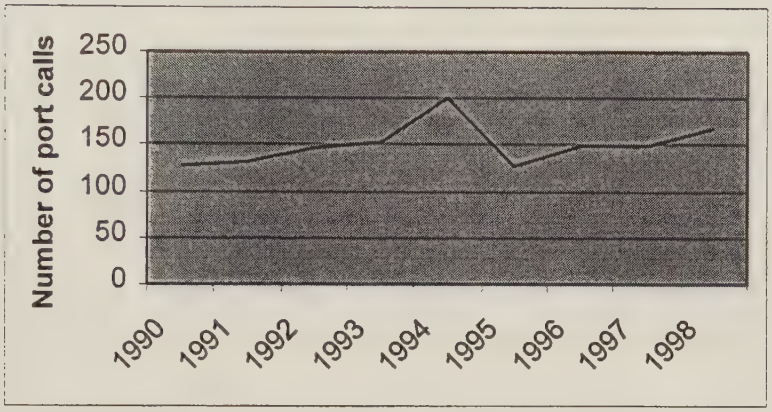
[20] This includes FOC vessels owned and operated by Taiwanese interests.

[21] See McCoy (1998) for a more complete review of vessel ownership and operation.

Port arrivals by purse seiners calling in American Samoa averaged 150 per year from the period 1990-1998, as shown in Figure 4. Unlike longliners, there is no discernable trend in vessel arrivals during the decade, although overall the fleet recently had a slight increase.

Figure 4. Port calls by purse seiners in American Samoa 1990-1998



Fishing operations are undertaken on free-swimming schools as well as schools associated with drifting objects: logs, including flotsam and other floating debris, and on man-made fish aggregating devices (FADs). Captains are required to report daily catch as well as bycatch and discards in the Regional Purse Seine Logbook. An active observer program is also conducted in the fishery by the Forum Fisheries Agency.

Since 1995 there has been a trend toward more sets on drifting objects, particularly man-made FADs, with a reduction in the sets on free-swimming schools (Coan, et al. 1999). This may have an implication for a greater incidence of sharks as bycatch, as observer data shows that "along with other large pelagic predators (e.g., billfish) several shark species seem to be more prevalent in the vicinity of logs and other floating objects that have 'aggregated' communities of baitfish and predatory tuna schools, than around schools of tuna that are 'free-swimming' and not associated with floating objects" (Williams 1997).

3.4.2 Taiwanese Longline Vessels Offloading in American Samoa

The Taiwanese vessels consist of two types: older vessels that are restricted by their refrigeration systems to delivering only cannery-grade albacore and those that are capable of holding both cannery grade albacore and ULT sashimi grade bigeye and yellowfin. All vessels are steel hulled and utilize Japanese machinery. The older vessels are generally smaller, under about 200-300 gross tons. The larger and newer dual-purpose vessels are all over 400 gross tons. Table 3 gives the general specifications of each of these vessel classes by size and target market.

While smaller vessels target only albacore, whether or not the larger vessels target albacore or sashimi-grade bigeye and yellowfin depends on the market conditions of each. Even

when targeting albacore, the bigeye and yellowfin components of the catch of the larger vessels can be frozen and kept at lower temperatures to enhance their value.

Table 3. General specifications of Taiwan albacore/ULT longline Vessels

	Cannery (small)	Cannery (large)	Cannery/ULT (small)	Cannery/ULT (large)
Year built	1974	1981	1990	1997
Length	29 meters	34 meters	34 meters	57 meters
Draft	2.5 meters	2.8 meters	2.8 meters	3.5 meters
Fish hold capacity	80-100 t	140-160 t	200-225 t	350-400 t
Freezer temp.	-20° C	-25° C	-45° C	-50° C
Main engine	470 hp	600 hp	600 hp	1,200 hp
Fuel capacity	100 kl	160 kl	160 kl	450 kl
Crew total	18-20	18-20	18-20	25-30

Source. Taiwan Deep Tuna Sea Boat Owners and Exporters Association

Some vessels, although not all, off-load their bycatch including mako sharks and frozen shark fins to rented freezer space at the canneries in American Samoa. This bycatch, and evidently an undetermined amount of frozen shark fin, are periodically taken to Taiwan by refrigerated carriers.

Taiwanese in the industry strongly believe that the type of fishing gear used has an affect on the numbers of sharks caught. Those vessels which switch to monofilament leaders, such as most of those in the South Pacific, tend to land fewer sharks. It was been pointed out by several vessel owners in Taiwan that the crews do not like this development, as this reduces their income from the sale of fins. The captain of a large, newer ULT-capable vessel believes that many sharks cut the leader and do not get hauled. He mentioned that in targeting both albacore and bigeye, they lose a large number of hooks but are not able to determine the reason why all hooks are lost. It is believed that some may be due to large sharks, billfish or other bycatch, and some from large sharks predating fish already on the line. One owner's representative said that his vessel fishing 3,000 hooks per set budgeted for 20,000 hooks per 6-8 month fishing trip.

The Taiwanese fish in the Pacific, Atlantic, and Indian Oceans with a fleet of over 200 vessels. In addition to landing in American Samoa, Fiji, and Tahiti in the Pacific, distant-water Taiwanese longline vessels utilize bases in Mauritius, Cape Town, Las Palmas, and Singapore. There is some mobility between oceans, depending on fishing conditions and overall market factors. In the Pacific, there are several fishing ground options depending on the target species and time of the year. When targeting albacore, as was the case in 1998, larger vessels (those over 400 tons and able to stay at sea longer and withstand more extreme weather conditions) have developed a pattern of fishing from September to February in fishing grounds to the north and west of Hawaii, and then returning to the South Pacific. Alternative ports utilized for off-loading depend on factors such as proximity to the fishing grounds and fish price. They include Tahiti (where the albacore catch is containerized for transshipment and the ULT sashimi grade tuna is transferred directly to refrigerated transport vessels) and the PAFCO cannery in Levuka, Fiji. There are reportedly shark fin buyers at each of these locations. Table 4 lists these general operating areas for targeting albacore, by size of vessel.

Table 4. Fishing ground options for Taiwan vessels offloading in American Samoa

Vessel size	Season	Area
Under 400 gross tons	May – August	30°S – 40°S, 170°E - 135°W
	September – April	10°S – 20°S , 175°W – 125°W
Over 400 gross tons	February – August	30°S – 40°S, 170°E – 135°W or 10°N – 20°N, 165°E – 170°W
	September – January	30°N – 43°N, 160°E – 170°W
All vessels	May- August	30°S – 40°S, 165°E – 180°
	September – April	10°S – 20°S, 165°E - 180°

In spite of the retirement of smaller longliners, the Taiwanese fleet in the Pacific, including FOC (flag of convenience) vessels, is expanding.[22] In 1998 an estimated 48 vessels from 200 to 400 gross tons were based in American Samoa, and from 4 to 7 delivered to Levuka in Fiji. While Lightfoot and Friberg (1997) reported 11 large ULT vessels of 500 to 700 tons operating in the region, by late 1998 the number had grown to about 20. Such vessels can operate in the more eastern regions of the Pacific noted in Table 4, transshipping both ULT sashimi-grade tuna and albacore for canning in Tahiti.[23] However, they can also call at American Samoa to off-load albacore directly, depending on target species and market conditions. Vessels are typically owned by Taiwanese family-based operations in Kaohsiung, with owners usually owning or having an interest in more than one vessel.

The newer and larger Taiwanese vessels are easily capable of fishing over 3,000 hooks per day. The material used for the mainline is kuronawa, with monofilament gangions or hook leaders.[24] The captain of a new Taiwanese 350 t capacity ULT longliner interviewed in American Samoa stated that the mainline on his vessel was 140 km (87 miles) long, but added that the distance covered by the deployed line was much shorter.

The domestic labor situation in Taiwan has made it increasingly difficult for Taiwanese owners to find captains and other officers to work on Taiwanese longline vessels. Salaries paid must be commensurate with other available employment to lure competent captains and engineers to work on these vessels. One captain interviewed in American Samoa had just previously worked on a Taiwanese squid vessel in the Falkland Islands. A second captain had transferred from a vessel in the Taiwanese Indian Ocean fleet. Remuneration for these captains was said to be on the order of $60,000 to $80,000 per trip (6 to 8 months or more). A chief engineer could be expected to earn about 70% to 80% of that salary, whereas an assistant engineer from mainland China was paid $1,000 per month.

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[22] Current Taiwan regulations allow newly built vessels as replacement for retired vessels only. However the restriction is only enforced for Taiwan flag vessels. There is thus an increasing trend towards registration in FOC countries.

[23] ULT-grade fish are shipped to Japan by refrigerated carrier, while albacore are placed in freezer containers for shipment aboard freighters.

[24] Lightfoot and Friberg (1997) reported that some smaller, older vessels in the Taiwanese albacore fleet still use wire hook leaders; however, this could not be confirmed in American Samoa in February 1999.

Only officers on the vessels are Taiwanese. Crew are usually from mainland China, although there are also some from the Philippines, Indonesia, and the Pacific Islands. The older, smaller Taiwanese vessels have a history of labor problems and disputes with Pacific Island crewmen. In addition to the strenuous working conditions, Gillett and McCoy (1997) described living and working conditions on these older vessels as

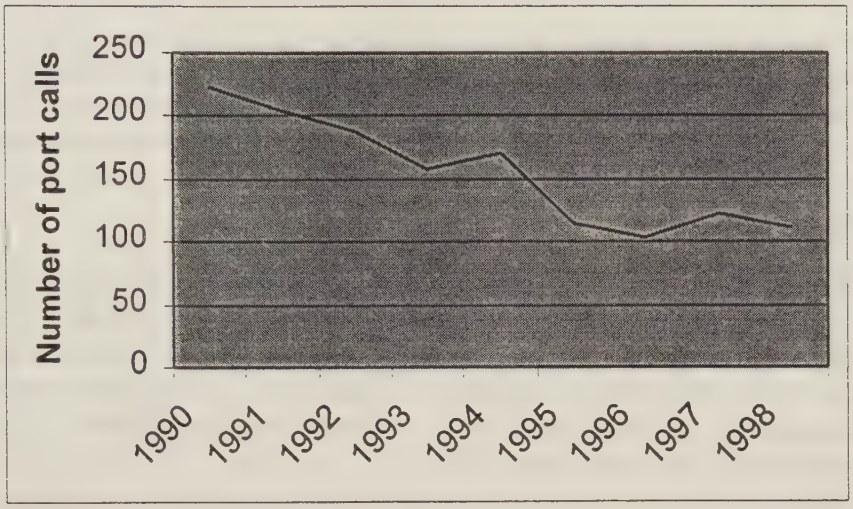
> ...being characteristically noisy inside, have poor ventilation and lighting, and there is no fresh water available for bathing. Pacific Islanders are frequently disturbed at the proximity of the food preparation areas to the toilet facilities. Even for those crewmembers that accept the lifestyle (as indicted by the completion of several contracts), there is the feeling that in periods of sickness or injury, the rest/recovery period allowed by the vessel captain is inadequate. The Taiwanese seem reluctant to return to port for even serious injuries. Another frequently heard complaint by Pacific Islanders is that many of the Chinese on board are totally inexperienced in longlining and are lazy.

Catch and effort data for the Taiwanese distant-water longliners has been collected for at least two decades by various institutions within Taiwan. However, there are significant problems with both the manner in which the data were presented as well as with interpretation (see Lawson, 1997b for a more complete discussion). Operating as essentially a high-seas fishery, the Taiwanese distant water longliners have never been required to carry scientific observers from either regional organizations such as FFA or the few coastal states that have licensed the vessels since the inception of 200 mile EEZ regimes.

Some steps are being taken to try and better determine bycatch, including sharks, by this fleet. Researchers at the National Taiwan Ocean University (NTOU), in conjunction with the Taiwan Deepsea Tuna Boatowners and Exporters Association, have provided logbooks and detailed instructions to captains for recording various bycatch species. Dr. George Chen, a world authority on sharks from NTOU has been involved in the distribution of shark identification sheets and has provided cameras to Taiwanese captains worldwide in an attempt to better document shark landings. To date there has not been any publication of results from these efforts, a problem perhaps compounded by the lengths of time the vessels stay at sea along with their scattered locations worldwide.

The number of port calls in American Samoa for all reasons by longliners dropped 50% from 223 in 1990, to 111 in 1998, as shown in Figure 5. This would tend to support the contention of two shark fin dealers active in 1997 who indicated that volumes had decreased substantially since earlier in the decade (Clemens, 1997) when there were greater numbers of longline vessels off-loading in American Samoa.

Figure 5. Port calls by longliners in American Samoa, 1990-1998



4. CURRENT PRACTICES IN COMMERCIAL FISHERIES AND ATTITUDES TOWARDS SHARKS

Understanding the reasons for disposition of the shark portion of the catch is dependent on understanding not only the current markets available to fishermen, but a number of other key factors as well. Current practices at sea by captains and crew, as well as their attitudes and those of vessel owners, shore-based agents, and others involved in the industry are dictated to a large degree by vessel size and configuration, source of crews, and relevant economic factors affecting fishing activities for the target species.

The incidental occurrence of sharks within the catch rather than being a target species influences their handling and disposition. Time and effort spent handling sharks for any reason is generally dependent on their impact on the vessel's ability to first successfully land and preserve the target species. Other factors determining onboard practices in some fleets include the price that the crew expects as a result of the time taken to handle or process sharks and the attitudes and directives of the captain or vessel owner.

The relatively recent awareness of shark conservation issues by the general public has filtered down to those participating in fisheries of the central and western Pacific in varying degrees. The U.S. and Japanese vessels have been faced with high profile conservation issues in the past and owners and captains tend to be more aware of concerns voiced by environmental groups that may affect their livelihood than any other nationalities engaged in these fisheries.[25] Although the Taiwanese were involved in high-seas gillnetting, both they and the Koreans appear to be less aware of, or less concerned with, shark resource issues at present.

4.1 Hawaii Longline Vessels

4.1.1 Perceptions and Attitudes towards Shark Conservation Concerns and Issues

More than any other group under discussion, those contacted in the Hawaii longline fleet, irrespective of their ethnic background, possessed the greatest awareness of current conservation attitudes. However, there was a general feeling that since blue sharks are plentiful, their actions were not harming the resource. Rather, the main concern of some was the public's perception of their fishing activities and the potential consequences that might arise from adverse publicity on the subject. Only one owner-operator expressed the opinion that finning sharks is a bad practice because it is ecologically unsound. He also mentioned that it created bad publicity for the industry and clashed with the general public's perceptions of "waste." However, even this owner allowed the crew to fin sharks that were dead when hauled, when time and space allowed. Several captains and crew who had fished on the U.S. east coast understood the concern over depleted coastal shark populations, but felt that this was not applicable to the pelagic sharks in the Hawaii longline fishery.

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[25] The U.S. purse seine fleet was made keenly aware of conservation concerns during the dolphin/porpoise controversy that drove the fleet from the fishing grounds of the eastern Pacific. The Japanese had to close down high-seas drift net fisheries targeting albacore, salmon and squid in the North Pacific.

A captain and crew of a longliner that targets tuna and who also had fished on the U.S. east coast felt that the finning practice was part of fishing and an important contribution to their income. The captain felt that the public's perception of waste of the rest of the shark was the main reason that there are moves to stop the practice of finning but that these perceptions didn't coincide with his in the case of blue shark, which has no commercial value other than its fins. In another case, one owner-operator felt that since his practice was to kill sharks anyway during fishing operations to minimize future predation, they might as well take the fins since they are of value.

Generally, most fishermen seemed to feel that sharks are, at best, a nuisance and at worst a serious threat to their livelihood. Catching too many sharks in an area, as is sometimes the case in fishing for swordfish, means that the vessel has to move because of the time taken to haul the line and the gear loss involved with catching large numbers of sharks. Interestingly, shark predation of fish still on the line is rarely mentioned in this context. Fishermen accept that this predation will happen, and that a certain amount of loss can occur. Still, fishermen will apparently take the opportunity to try and minimize future predation by killing sharks when caught long as it doesn't interfere with their primary objective of landing and caring for the target species.

Of the owners and captains who expressed concern that the practice of finning was "bad," or "too much waste," none said they prohibited their crew from taking fins when it did not interfere with fishing activity. During an interview, one owner-operator stressed several times that he thought it bad in principle to be killing sharks, but that cutting off so many hooks was expensive. By participating with the crew in the proceeds from the sale of shark fins, this particular owner-operator believed that taking fins helped to offset the losses to his operation that accumulate over time.

4.1.2 Landing and Handling Practices

The attitudes of captains and some owners (not owner-operators) seemed to diverge on the issue of bringing sharks aboard. Several owners believed that the practice is dangerous and mentioned that they had been sued in the past by injured crew. One owner said that the major concern with shark finning was safety. The owner stated that that the crew is allowed to take some fins for personal consumption but realizes they probably fin a lot more for sale. In contrast, the general attitude of captains interviewed was that any shark is dangerous if you don't know how to handle them, or if you're not paying attention when they are brought aboard.

Since not all sharks that are hooked are brought aboard to be finned, captains and crew contacted were asked about the decision process that determines whether or not a shark is to be finned. The most common comment was the obvious: the sharks are not as important as the target species and are cut off or thrown overboard if they interfere with the landing and handling of fish on deck. It takes about two to three minutes to land and fin a shark, according to one captain. The time involved in finning many sharks is balanced with the amount of fish being caught. Usually if a shark is landed, i.e., brought aboard, it will be finned.

According to the NMFS Southwest Fishery Center's Honolulu Laboratory, trips taken by longliners targeting tuna take the fins from a greater percentage of the sharks caught during those

trips than those vessels targeting swordfish or undertaking trips with mixed targets. In 1998 the vessels targeting tuna finned about 85% of sharks captured, while 48% or so were finned during swordfish trips. The mixed target trips accounted for the least in terms of percentage of sharks caught that were finned, about 40% (Ito, 1999a). It is possible that the greater amount of time required to handle and properly store swordfish than tuna may be a factor in determining the percentage of sharks finned. It may also be due partly to the rougher sea conditions encountered by swordfish longliners during much of the year.

Most captains queried agreed that the species of shark, its condition and the current intensity of fishing are all factors determining which sharks are to be retained whole or only finned. Sharks that are "green," that is those that are particularly active and might pose a threat to the crew or slow the pace of fishing, are cut off. Live threshers are also usually cut off, unless a decision is made to retain the carcass for possible sale in Honolulu. When sharks are landed and retained for possible sale in Honolulu, the only two species considered are threshers and makos. One captain mentioned that if makos or threshers were to be retained for possible sale, only those caught during the last 2 to 3 days of the trip were kept. Storage limitations and possible tainting of the rest of the catch were the reasons for not retaining these two species earlier in the trip. Makos that are too large to be handled easily or ones that are too small are also cut off. It appears that many crews will cut off large and still lively sharks because of the time it would take to safely land and process the fins.[26] Smaller sharks, mainly 3-to 4-ft-long blue sharks, are also cut off.

The crew of one larger swordfish vessel stated that the captain made the final determination on whether or not to land a shark. The main determinant on this particular vessel seemed to be shark size: if it took one or two men to pull it aboard, then it was generally acceptable to do so. However, if it took three men or more then the shark was probably going to be to much trouble to handle on deck and was usually cut loose.

One owner of a swordfish vessel stated that in the past when prices were higher, crews had become too involved with finning and neglected the fish. This comment was not heard from owner-operators, probably because they would generally be better able to control crew activity on board than an owner with a hired captain.

The issue of potential hook loss was mentioned by several captains who are owner-operators and therefore might be expected to be particularly sensitive to fishing expenses and gear loss. When hook (and wire leader in the case of tuna targeting) loss is discussed, it is difficult to assess motivation for landing the shark since to retrieve a hook one would first kill the shark. At approximately $2 per hook plus leader, there is an incentive to minimize gear loss, particularly when a large number of sharks are encountered on a particular set. However, a set of fins from a 45 kg shark would currently be about seven times as valuable as the hook and leader. Since it is assumed that the hook is retrieved from every finned shark, it is difficult to see how the hook alone would be the incentive to bring the shark aboard and kill it. It is probably more likely that the decision to bring a shark aboard and both retrieve the hook and take the fins is dependent on several factors noted above, as well as the pace of fishing on that particular set.

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[26] A few vessels utilize a 220-volt electrical line rigged to a gaff to stun sharks before landing them and are not as concerned about the larger sharks.

Information on the disposition of sharks captured in Hawaii's longline fishery is kept by the Honolulu Laboratory. Table 5 below provides a summary of log book data on the disposition sharks of since 1991. It is believed that the jump in numbers between 1994 and 1995 for finned sharks may be due in part to a change in the log book format, which prior to 1995 had only one entry block to show retained sharks. There was no distinction to be made on the form between sharks retained whole and those whose fins had been retained unless noted by fishermen.

Table 5. Summary of disposition of sharks caught by the Hawaii-based longline fleet, 1991-1998

Year	Number Caught	Number Released	Number Finned	Number kept whole
1991	71,183	68,894	0	2,289
1992	94,897	91,292	977	2,628
1993	154,608	137,846	14,355	2,407
1994	114,656	98,119	14,404	2,133
1995	101,292	67,760	32,526	1,006
1996	100,992	57,254	43,769	573
1997	85,838	36,496	48,769	573
1998*	97,080	38,887	58,444	749

*Data for 1998 is preliminary.
Source: NMFS Honolulu Lab

Most crew have either been instructed by buyers on the proper cutting of fins and handling to minimize spoilage or know such techniques and methods from fishing in the U.S. east or gulf coast fisheries. They know, for example, that the usual practice is to retain for sale the dorsal, two pectorals, and lower caudal fins, strung together as a set. While some newer crew might think they will get paid more by weight if they leave some meat on the fin, they quickly learn that discriminating buyers deduct for such practices.

Properly cut shark fins take 3 to 4 days to dry, usually in the sun. They are then stored in the engine room or a dry locker area where they can remain dry for the duration of the trip. When mako or thresher shark are retained for sale, the fish are gutted and iced.

A small but undetermined numbers of shark gall bladders are taken from sharks for sale by fishermen on board some vessels. The gall bladder is apparently processed ashore as a Korean folk medicine. Taken with liquor, the gall bladder is said to relieve backache.

Although it is known that blue sharks can produce superior leather (Rose, 1996) there has been little or no attempt by crews to retain the skin of blue sharks for sale.[27]

Secondary fins, the much smaller pelvic and anal fins known as "chips" are retained by the crew of some vessels for sale. The price for such fins is much lower than the larger fins that comprise a set of fins from a single shark, perhaps only one quarter the value by weight.

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[27]To be of value, blue shark skins must be carefully cut from the body and be free of cuts and damage as might occur during the course of a shark's life or by handling on board. It was reported that one shark fin buyer was interested in purchasing shark skins, and a longline vessel had brought in one or more as a test in mid-April 1999.

Revenue from shark fins is almost always given to the crew. On owner-operated vessels it appears fairly common for the boat to get a share of the fin money. All vessel owners with hired captains who were contacted said their crews retained all shark fin money and none was given to the owner. Several owners of vessels that target tuna exclusively said that the money earned from the sale of shark fins was especially important to their crews after poor fishing trips. According to these owners, during such trips it was possible that an individual crew share of shark fin revenue would exceed their share from the sale of the catch.

4.2 High-Seas Longline Vessels Transshipping Shark Fins to Hawaii

Very little is known about the crew attitudes or practices on board Korean longline vessels that transship shark fins to Hawaii. From knowledge of other high-seas longline fleets such as the Taiwanese, it is reasonable to assume that most or all sharks that can be brought on board are finned. The relatively large size of the vessels employed in high-seas fisheries provides deck space to conduct finning activities and an adequate supply of low cost (mostly Asian) labor for the manpower to remove the fins and clean, dry, and store them on board.

It can also be surmised that while most or all sharks caught by Korean ULT vessels will be at least finned, there is also the probability that makos are retained as they are on Taiwanese high seas longliners. If retained, makos will be shipped to Japan on ULT refrigerated carriers along with the sashimi grade tuna, as is the practice by Japanese distant-water longliners participating in the same fishery. The greatest incentive to fin these sharks is the availability of a means to get the fins to market. In the current logistics of the fishery this is the opportunity to sell fins to buyers who have the ability to transship in Hawaii. The availability of a market for the fins, coupled with the existence of crew from mainly lesser developed nations who would have the economic incentive to undertake the additional work involved point to a high utilization of sharks for their fins by Korean ULT vessels.

On January 19, 1999, short news stories were aired on Honolulu television stations about a shipment of fins from this fleet landed at Pier 37 and placed into a container under bond for transshipment to Asia. From the 5 or 6 second video film clips shown, most fins appear dried, bundled and tied with old kuronawa longline. They appear to be sorted by species, although it is difficult to tell. Many of the caudal fins visible in the videotape appear to be whole. That is, the more valuable lower caudal is not separated from the upper caudal fin.[28] This may be done because of time constraints while finning on board the vessel, or because of the desire of the eventual buyers in Asia to more accurately cut and trim the fin themselves to maximize its value.

The situation with regard to the retention of dressed sharks is less clear. No shark meat is transshipped through Hawaii, so the only opportunity for marketing this commodity would be via the ULT carriers that return the bigeye and yellowfin catch to Japan and Korea. Frozen shark fillets (assumed to be mako only) from Japanese, not Korean, distant-water longliners were quoted in a Japanese fishery trade paper in December, 1998 at a relatively high price of 250 yen per kg, or $2,083 per t. With shipping costs aboard ULT refrigerated carriers from the central

[28] The upper caudal fin is not used for shark fin soup, but can be processed for another product used in Chinese culinary practices. This utilization is known in Taiwan, but not in Hong Kong.

Pacific to Japan about $600 per t (Lightfoot and Friberg, 1998), there exists an incentive for Korean ULT vessels to retain mako sharks for the Japanese market.

4.3 Foreign Longline Vessels Off-loading at Guam

4.3.1 Japanese Longliners

The limited freezer space on board and the fact that all tuna are carried in RSW reflect the concentration of Japanese longliners on the target species and relative disdain for handling or concerning themselves with bycatch, including sharks. Japanese vessels will retain some bycatch for the crew's consumption and freeze some economically valuable bycatch species, such as wahoo.

Generally, agents of Japanese vessels landing in Guam are aware of concerns over shark bycatch and the issue of finning. The owners' association, the National Offshore Tuna Fisheries Association (Kinkatsukyo) based in Tokyo, is acutely aware of bycatch issues and was helpful in research for this study.

Although vessels are based in Guam, most fishing takes place in the Federated States of Micronesia or on the high seas. From the volumes of shark fins estimated to be landed in Guam it is clear that sharks are finned in this fleet, even though as noted above very few, if any, are retained whole. Observer data from the Micronesian Maritime Authority (MMA) from 1995 to 1998 covering 13 trips aboard Japanese longliners showed that retention of fins and trunks comprised 4.9% of oceanic white-tip sharks and 5.6% of short-fin mako sharks. However the overall sample is very small, and the total numbers of sharks caught are correspondingly small: 41 oceanic white-tips and just 18 short-fin makos (T. Park, pers. commun.). While the data sample itself is small it, does correspond to what fishing captains, agents and others familiar with the fishery in Guam described as the general practice among the Japanese fleet: namely that sharks are rarely retained, usually for crew consumption but rarely landed for sale of the meat.

4.3.2 Taiwanese Longliners

The Taiwanese attitude toward longlining mentioned in Section 3 is fostered by a traditionally large and strong market in Taiwan for species caught incidentally to tuna by the longline method. Guam's proximity to Taiwan reinforces this attitude and enables Taiwanese fishermen to gain greater economic value from their overall catch than would otherwise be available solely from tuna.[29]

Only a few species of shark landed as bycatch by Taiwanese vessels operating from Guam are kept for their meat. Agents in Guam reported that the most common sharks retained in the tropical western Pacific are shortfin mako, oceanic white tip, and silky sharks. Silky sharks

[29] This does not necessarily mean Taiwanese vessels are more profitable than Japanese vessels when targeting bigeye or yellowfin. The Japanese claim their use of kuronawa fishing gear and line shooters when using monofilament allows them to maximize tuna catch and minimize bycatch by fishing deeper.

are also kept and utilized for the crew's food on board.[30] Blue sharks are normally finned and discarded. This information conforms to observer data from the MMA. As with the Japanese data described above, the sample size is very small: only 15 trips over a 4 year period from 1995 to 1998. Data show that about half or 48% of 555 silky sharks captured were retained, as were about 43% of 135 oceanic white tips and 84% of 43 short fin makos. On the other hand, 95% of blue sharks were finned with the trunks discarded.

The reason blue sharks are not retained on board appears to be that their price in Taiwan is too low to justify the retention, handling, and shipping costs involved. Space in the fish hold is reserved for higher value species of bycatch such as wahoo or mahimahi, some of which can be profitably sold ashore in Guam rather than being shipped back to Taiwan. However, if a vessel is on its last trip before returning to Taiwan and has fish hold space available, the crew will take the blue sharks with the intention of receiving at least some value from them.

Williams (1997) has remarked on the variety of uses for shark products on board some Taiwanese vessels. Quoting an SPC observer report he mentions that "skins of oceanic whitetip shark and silky sharks were retained and prepared as a delicacy for the crew," and "on longline vessels carrying live bait (milkfish), some of the retained shark trunks were prepared as a food supplement for the bait...with shark meat sometimes being stripped and salted, and used for bait later in the trip."

It was not possible to interview Taiwanese captains in Guam during the course of this project, so their perceptions and attitudes towards shark conservation and issues of shark utilization could not be collected first-hand. However, two Taiwanese agents in Guam who represent the vessels noted that Taiwanese consider their utilization of resources to be rational, given the economic realities of their operations so far from home. This is evidently based on the fact that these same vessels would retain and land blue sharks if they were fishing close to Taiwan. However, since tuna fishing was generally better in the southwest Pacific, it was the limited capacity of their vessels and the distance from Taiwan that forces them to reduce the amount of bycatch they might otherwise land.

4.4 Industrial Fishing Vessels Off-loading in American Samoa

4.4.1 U.S. Purse Seine Vessels

In addition to captains and owners in the Hawaii longline fishery, captains and managers of U.S. purse seiners appear to be highly aware of conservation concerns over bycatch in their fishery. Most of those involved in the fishery today are veterans of the controversies over the issue of fishing "on porpoise" during the 1980s. This experience, coupled with the increased scrutiny of the U.S. government, including the placement of a significant number of observers from FFA countries required by the multilateral tuna treaty, has increased the awareness of captains and managers to resource issues in fisheries of the central and western Pacific.

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[30] One agent in Guam with extensive experience in Micronesia as a fleet manager believed that the eastern parts of Micronesia toward the Marshall Islands produced more silky sharks than in the west, and that as a result fewer sharks of this species were brought to Guam.

Having had generally an adverse relationship with conservation groups over the "porpoise issue," captains and vessel managers are careful to put their fishery in the best possible light when discussing other conservation issues such as those associated with bycatch.. Some of those contacted onboard U.S. purse seine vessels in American Samoa remarked that they knew of some vessels that did not allow finning; those vessels could not be identified.

Captains and crew realize that handling sharks can be dangerous on any vessel. On purse seiners, a particular hazard occurs when sharks are caught in the net and pulled toward the power block high off the working deck and net stacking area. Once they break free, they can fall on crew working below and cause serious injury.

Unlike longline fisheries where each shark is brought to the vessel individually, sharks are caught in a purse seine net along with the target species (skipjack and yellowfin) and are generally brailed onboard with any other incidental bycatch. All fish brailed aboard are dumped onto the hopper placed on deck leading fish down chutes to the brine tanks below. It is the usual practice for crew to quickly pull out sharks that get into the hopper and place them on deck out of the way. Most or all are usually dead at this stage, according to those who have worked on the boats.

The factors determining the number of sharks that might be finned include:

- Other activities requiring crew attention on the boat.
- Presence of those in the crew with experience in finning, particularly Asian (including Filipino) crew.
- The expected price in port.

Other activities usually would not interfere with finning, as it is usually conducted after all other work is completed. However, some events or activities such as immediate repair to the net or machinery could result in sharks not being retained for finning.

The number of sharks that can be finned and the fins washed and properly cared for is limited by available manpower. Proper cutting and cleaning are essential to obtaining the best possible price, and lessen the unpleasant odors associated with the curing and storage on board. Generally it is the Filipinos in the crew who understand best the methods of finning and the importance of cutting fins properly to obtain the best price. Not all crew participate in the finning, particularly as prices have dropped to around 50% of those paid a few years ago. It is also the Filipinos and some Pacific islanders who are the most intense about finning the sharks brought aboard the seiners. They are usually among the lower paid of the deck hands and are willing to do the extra work after the vessel has been cleaned up. For example, on a U.S. seiner off-loading in American Samoa in early 1999, only the six Filipino crew participated in finning and were the recipients of proceeds from the sale of the vessel's shark fins.[31] A Pacific islander joining another vessel in American Samoa was happy to learn that there were only two Filipinos on the crew, as he expected to be able to earn a greater share assisting in the cutting and preservation of the fins.

[31] This practice is not universal, however. There were reports of vessels that shared the shark fin money equally among all crew (non-officers). The assumption being that while some crew were taking care of the sharks, other crew took over their jobs and were entitled to a share.

The crew knows the general prices for shark fins in port in American Samoa from previous trips and sales in port. Fin sales are negotiated with the buyer(s) at the end of each trip and there appears to be no set or guaranteed price prior to arrival. Some crew mentioned that when fin prices were high 2 or 3 years ago, buyers would wait on the dock and be ready to bargain as soon as the vessel tied up. In recent years the transactions have become much less intense.

As with all fisheries surveyed, the captains of purse seiners are most concerned about catching and preserving the target species in the quickest possible time to minimize spoilage. Unlike some other fisheries where deck crew are paid a basic salary, all crew wages on purse seiners are based on the amount of fish landed and accepted by the cannery. It is thus in everyone's best interest to exert maximum effort to take care of the tuna and skipjack. It is the job of the deck boss to make sure that everyone is working toward that end and not being distracted.

After all work relating to the fishing operation is completed and the gear properly stowed, two or three crew remove the fins while others assist in washing and cleaning and discarding the carcasses overboard. Fins are strung together in sets and placed in a location near the exhaust stack to dry. Further drying can be accomplished in direct sunlight or on the outer exhaust cowling.

Not all crew are involved in finning on board U.S. seiners. In the past when prices were higher, many of the crew would helped out and be compensated after fins were sold. However, with prices far lower than in the past, it was reported that those with higher pay rates are either not interested or allow those with lower pay rates to benefit from the trade.

Upon arrival in port after clearances are granted and official business taken care of, it is usually the deck boss who negotiates with buyers, and is in charge of dividing the proceeds among the crew. The timing of the actual sale is dependent upon the offloading schedule for the purse seiner at the cannery and the existence of other pressing issues.

4.4.2 Foreign Longline Vessels

Sharks are important to the owners of Taiwanese longline vessels that call in American Samoa mainly because the contribution of revenue from fin sales to overall crew compensation assists in reducing labor costs. The owners and owners' representatives interviewed in American Samoa as well as in Taiwan do not believe there was a resource problem with sharks. As astute businessmen, they are aware of resource issues bearing directly on their fishing activities, but have generally not considered shark resources as something to be concerned about. But those who are concerned see economic impact on vessel operation when crew income is affected by low fin prices.

These attitudes can best be understood in the overall context of Taiwanese fisheries in general. A large percentage of the sharks caught in nearshore fisheries in Taiwan are utilized for various food products. The Taiwanese also participate in several directed shark fisheries, mainly in southeast Asia and in two locations in the Pacific islands. Thus for owners of distant water

vessels calling at American Samoa, their background provides a different orientation toward sharks that is different from U.S. purse seine vessel operators.

Two captains of Taiwanese longliners in American Samoa stated that all hooked sharks are brought on board and utilized for their fins. Blue sharks and others are subsequently discarded and only makos retained for sale as frozen trunks. In some instances other shark species are retained as food for the crew but no detail on these was given.

The trend in recent years towards larger vessels in the Taiwan fleet has given the operators greater discretion in how fins are handled onboard. Some or all fins may be retained as "wet" fins, frozen, and stored in either the fish hold or in bait storage areas during a voyage. According to the Taiwanese, in some instances processors who can process wet fins will pay more, since they can better control the processing and produce a better product.[32] The trend has apparently been to freeze blue shark fins while continuing to dry the "brown" sharks such as oceanic white tips and silky sharks.

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[32] Blue shark fins are said by the Taiwanese to tend to disfigure more than other species during drying. This may make later processing more difficult and increases the value of wet fins.

5. EXISTING MARKETS FOR SHARKS AND SHARK FINS FROM DOMESTIC VESSELS

In spite of the occasional use of some sharks for human consumption in the U.S. flag areas of the Pacific, in terms of monetary value the most important product obtained from sharks is the fins. The trade is driven by the Asian culinary demand for the material to be used predominantly in shark fin soup, a delicacy that has been served for more than 2,000 years to honor special guests or special occasions (Kiyono 1996).

5.1 Overview of the Shark Fin Trade

It is the ceratotrichia, called variously fin needles, noodles, or fiber, one of several types of cartilage found in many (but not all) species of sharks that is used in shark fin soup. It is separated from other cartilage during a laborious process that involves descaling and skinning of raw fins, boiling, removing fin ray membranes, bleaching, and drying in multiple and differentiating steps to produce a variety of final product forms. The most important traits of ceratotrichia in valuing shark fin from different species are their thickness and length. Shark fins that yield long, thick fin needles are those that command the highest prices.

While it is agreed that different species of shark provide different quality ceratotrichia, various sources in the business have provided sometimes conflicting information about the relative value of fins from various species. This is made more complex by different sizes of the same species being graded differently, and specific fins within a species possessing different quality fin needles, both in size and in thickness.

The world trade in shark fins has occurred for centuries, with much of it either destined for, passing through, or consumed in Hong Kong (Rose 1996). Beginning with China's reform policies instituted in 1986, changes took place in Hong Kong's trade in shark fins that continue to this day (Parry-Jones, 1996). The 1986 reforms allowed the establishment of shark fin processing operations in southern China, making it possible for Hong Kong to both avail itself of cheaper labor for fin processing and to open up new markets, particularly in the booming southern China region. This era marked a general softening of previous official attitudes in mainland China towards "elitist" foods that were discouraged during the Maoist era. The Hong Kong economy also greatly expanded during this period. One author described its impact on the popularization of shark fins:

> Whereas shark fin used to be a high-priced delicacy found only in expensive shark fin restaurants, there are now many smaller restaurants specializing in shark fin soup, and importing and processing their own shark fins. This popularization of shark fin has made shark fin soup more accessible as it is now possible to eat shark fin soup at a more reasonable price and during more casual occasions; in the past, shark fin was consumed by those of lower economic status only during formal banquets (Parry-Jones,1996). [33]

[33] It should be recognized that there are numerous levels of quality in the ingredients, preparation, and presentation of shark fin soup. A bowl of soup can be purchased for as little as $5 in some restaurants, with various flavorings added. At more exclusive restaurants, the cost (and presumably the quality) could easily be fifteen times that figure.

During the period from 1986 to 1995, the volume of dried shark fin imports to Hong Kong steadily rose from about 3,000 t to a little over 4,000 t (Parry-Jones, 1996). In 1997 the import amount had leveled off at 4,215 t, while in the first 11 months of 1998 it dropped 13% to 3,723 t.[34] Government officials in Hong Kong have said that they expected imports in the near term not to increase over 1997-1998 levels as long as current economic conditions in Asia remain depressed (S.F. Leung, pers. commun.).

The period during which the increased popularization of shark fin took place was followed almost immediately by the current downturn in Asian economies, including those in southern China and Hong Kong. One major effect of the economic crisis in Asia has been the devaluation of currencies in many of the countries that supply shark fins to Hong Kong. Since Hong Kong's currency is pegged to the U.S. dollar, in recent years traders there have been able to obtain supplies from many sources at lower cost, possibly making supplies from the U.S. flag areas less competitive.

Cost is just one of several factors in determining preferences among buyers. Not all shark species possess fins of equal quality, not all fins from the same species have the same characteristics, and not all shark fin producers provide products of equal quality. Fins from pelagic fisheries are usually graded at the ex-vessel transaction point according to shark species or size. Species are grouped according to the color of the skin ("brown" for oceanic white tips and silky sharks for example) with the fins from blue sharks segregated. Further grading is determined by size, dryness, smell, and the method of cutting (Lai, 1983). These factors are all taken into account by the experienced buyer in the determination of the price. With fins from different species having different levels of desirability, varying quality levels and methods of preparation, it is almost impossible for any concrete values to be assigned to the product at early stages in the trade. Fluid influences of supply and demand are tempered by the product's long shelf life and the relative ability of traders to withhold supplies from the market.

Although import documentation includes a declared value, many factors in the country of origin of the shipment may affect the setting of such a declared value. Export taxes are one example; withholding of marketing information from competitors is another. In spite of general price guidelines set by market movements that may be known to buyers and their agents, the nature of trading at the initial ex-vessel purchase point can affect price as well. Local currency value versus Hong Kong (or U.S.) currency is one factor. The level of sophistication and ability of fishermen to recognize which fins are valuable is also important.[35] The number of buyers in a given locale and the level of competition is another factor in varying prices.

Hong Kong's role as an entrepôt for the global trade is one that has been described as "both extremely active and complex." It includes importing, exporting, and re-exporting of raw material, and processed or semi-processed shark fin (Parry-Jones 1996). Since many countries producing or exporting shark fins do not maintain reliable statistics on these activities, the import

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[34]From Parry-Jones (1996) and unpublished data from the Agriculture and Fisheries Department. These figures do not include imports from China, which distort overall imports because of processing there and re-importing into Hong Kong.

[35] At one island location, fins from hammerheads that are not usually encountered during normal fishing practices were thought by fishermen to be of low quality, as they received low prices from traders. In fact, it is one of the few species that most traders in Hong Kong can agree is one of the most valuable.

levels of shark fins into Hong Kong are generally used as an overall gauge of worldwide trade and a more specific benchmark for the activities in particular countries.[36]

General information on the shark fin market in Hong Kong has evidently always been difficult to collect, since it is a business controlled by relatively few traders who see little benefit in divulging details of their business practices (Q. Fong, pers. commun.).[37] The ability of outsiders to gain any significant insights into the business was compounded in 1994 with the Resolution on the "Trade in sharks and shark products" passed at the Ninth meeting of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The resolution called for the collection of data on the status of shark fisheries and trade in shark products, but those involved in the trade in Hong Kong believed that CITES attention could result in a trade ban and as a result have been unwilling to discuss the trade in detail, if at all (Parry-Jones, 1996).[38]

Defining the total volume of shark fins imported into Hong Kong prior to 1998 is difficult because of the inconsistent use of generalized customs categories dating back to 1980. It is very hard to determine the volume of specific products as well as the volume of re-imported processed fins that may have been double-counted in import statistics.[39] Since 1998, government statistics in Hong Kong have provided a more accurate breakdown within several raw and semi-processed product categories. The presence of mainland China in the data may distort the contributions of other countries, as it is assumed that most of the fins imported in the first and third categories below are actually re-imports after processing. The new customs categories and total imports recorded by the Hong Kong Department of Agriculture and Fisheries for the first 11 months of 1998 (with totals excluding mainland China shown in parentheses, where applicable) are:

- shark fins (with or without skin), with cartilage, dried, whether or not salted but not smoked: 4,235 t (3,482 t)
- shark fins (with or without skin), with cartilage, salted or in brine, but not dried or smoked: 2,178 t (2,133 t)
- shark fins (with or without skin), without cartilage, dried, whether or not salted but not smoked: 1,195 t (241 t)
- shark fins (with or without skin), without cartilage, salted or in brine, but not dried or smoked: 37 t (6 t)

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[36] As a duty-free port (except for alcohol and tobacco) volumes of imports and exports are thought to be accurate, according to the Hong Kong administration.

[37] There were 86 members of the Hong Kong Shark Fin Importers and Processors' Association in 1996. Most are also reportedly involved in the trade in other dried marine products, such as abalone and beche-de-mer (Q. Fong, pers. commun.).

[38] A notable exception is the information collected and presented in Fong (in press, 1998). The author's academic standing and the credentials of his major professor/advisor were instrumental in assisting his gathering of information. Nevertheless, while his Hong Kong background helped in language and providing cultural insights, he was also greatly distrusted because of it and spent many months gaining the confidence of traders to enable his research to proceed (Q. Fong pers. commun.).

[39] Because of the labor-intensive nature of processing and the availability of cheaper labor in southern China, shark fins are sent there for processing and then re-imported to Hong Kong for either local consumption or re-export.

For comparative purposes Table 6 identifies the top three countries in each category, exclusive of China because of their current processing and re-importing role. It should be kept in mind that the weights expressed in the separate categories are not directly comparable, as the third category is a more processed form of the first, and the second and fourth categories represent fins imported wet rather than dried.

Table 6. Countries from which Hong Kong imported the greatest volumes of shark fins, January – November, 1998, and percentage of overall imports into Hong Kong, exclusive of those from mainland China

	Dried, with cartilage	Salted or in brine, with cartilage	Dried, without cartilage	Salted or in brine, without cartilage
Total	3,482	2,133	241	6
United Arab Emirates	422 (12%)			
Japan	293 (8.4%)			0.4 (7%)
USA	286 (8.2%)			
Spain		1807 (83%)		
Taiwan		80 (3.6%)		
Mauritius		71 (3.2%)		
Argentina			39 (16%)	
Mexico			38 (15%)	
South Africa Republic			37 (15%)	
Philippines				3(50%)
Thailand				1(17%)

Units: metric tons; Figures are rounded to nearest t.
Source: Hong Kong Agriculture and Fisheries Department, unpublished data

The inclusion of the United Arab Emirates is worth noting because along with North and South Yemen and Bahrein it has been a transshipment point for shark fins to Hong Kong for years[40]. During 1991 as Hong Kong's demand for shark fin increased, the Gulf war affected supplies coming through that region and further encouraged the search for new sources of supply.

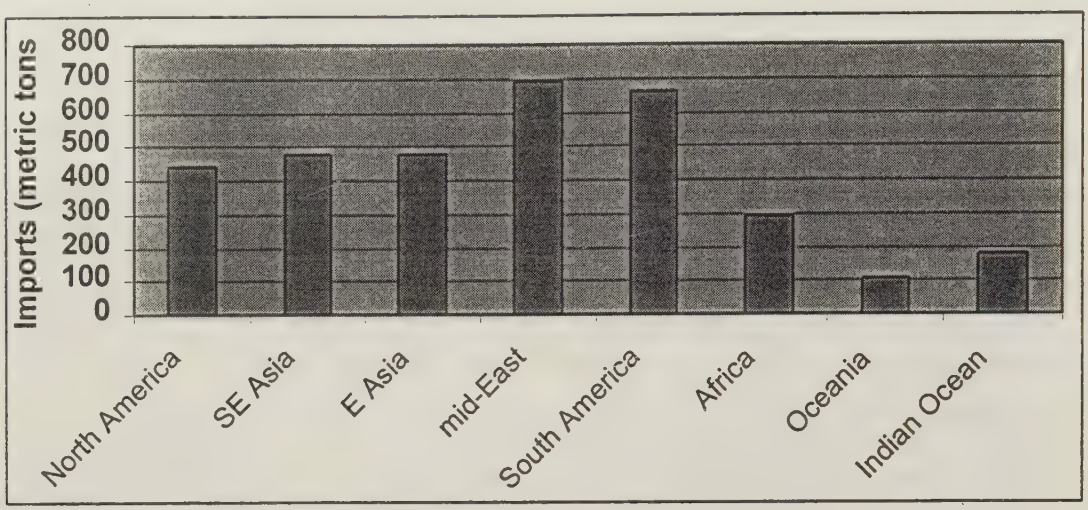
Although import totals from some individual countries may appear small in isolation, aggregating the data of individual countries by geographic regions gives a better idea of overall trade flow worldwide and puts the volume contributed from shipments from Oceania in perspective. Figure 6 shows the amount imported into Hong Kong from Oceania,[41] 105 t or

[40]The source of fins transshipped through these areas was not determined. It is assumed to be those areas in the western Indian Ocean, including the Persian Gulf and Gulf of Oman down to East Africa where Arab traders have traditionally been active.

[41] Oceania includes Samoa, Australia, Solomon Islands, Fiji, New Zealand, Papua New Guinea, and U.S. Oceania. There is no description or explanation of which states or territories comprise U.S. Oceania in Hong Kong trade statistics.

about 3.4% of the total, compared to other regions of the world from January through November 1998.

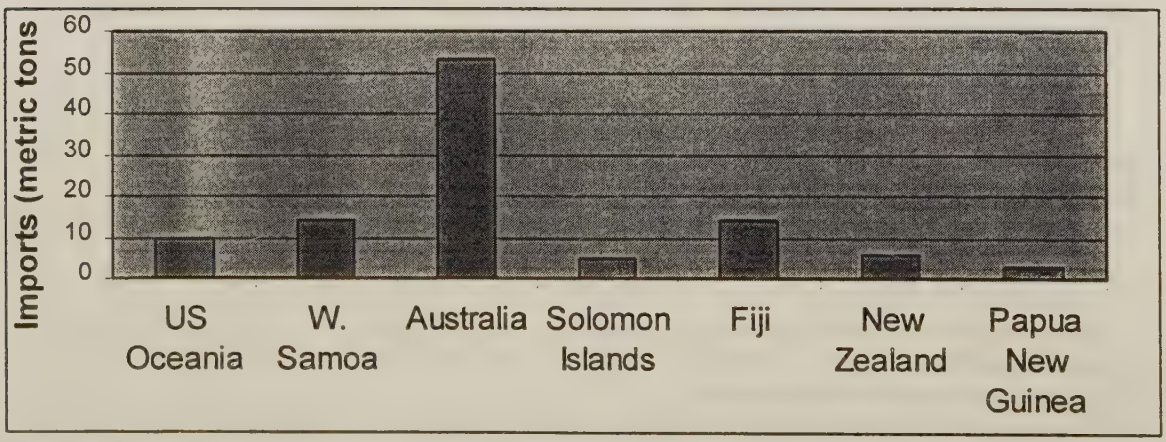
Figure 6. Hong Kong imports of dried shark fin by geographic region, Jan. – Nov. 1998



Source: Hong Kong Agriculture and Fisheries Department, unpublished data.

As mentioned above, it is probable that fins originating in or transshipped through Hawaii are included in totals for the U.S. as a whole, and that the Western Samoa total may well include fins transshipped from American Samoa. The U.S. Oceania totals may therefore represent Guam and perhaps a portion of American Samoa's totals. Of the seven countries contained in the Oceania category, Australia is by far the largest source of imports with 53 t or 50% of the total during the first eleven months of 1998. By contrast U.S. Oceania imports of a little over 10 t, represent about 9.5% of total imports from Oceania. Figure 7 depicts the relative volumes from the various countries comprising Oceania.

Figure 7. Hong Kong imports of dried shark fin from selected countries in Oceania, January–November 1998



Units: metric tons; Figures are rounded to nearest t
Source: Hong Kong Agriculture and Fisheries Department, unpublished data

With the U.S. being a relatively important exporter of dried shark fin to Hong Kong, it is interesting to note the records of U.S. exports. The U.S. Foreign Trade Division of the Census Bureau only began compiling separate export data in the category "shark fins, dried" only in 1998. Prior to 1998 shark fins were apparently counted along with sharks and shark products.[42] These current trade data are also available from the Fisheries Statistics and Economics Division of NMFS. Statistics do not differentiate between dried shark fin with cartilage and without, so it is not possible to determine the degree to which any exported fins have been processed. In 1998 U.S. export trade data recorded just over 141 t of dried shark fin in 1998, with Hong Kong being the major recipient, as shown in Table 7.

Table 7. U.S. Exports of dried shark fins, 1998

Country	Volume (t)	Declared value	Value per kg
China	.239	$8,640	$35.15
Hong Kong	135.063	$1,242,437	$9.20
Japan	5.847	$13,000	$2.22
TOTAL	**141.149**	**$1,264,077.00**	**$8.95**

Source: NMFS

Obviously, the total volume shown in U.S. export data does not match Hong Kong import data. There is no explanation for this, even considering that some areas such as Guam and American Samoa are outside the U.S. Customs district and data are not collected by the U.S. in those areas (NMFS Fisheries Statistics and Economics Division, pers. commun.). It is impossible to tell if declared values represent real values. One might expect exports to Japan to be undervalued, given the practice there of imposing tariffs on imported marine products. The volumes and values for Hong Kong, which is duty free, coming from the U.S. where no export duty is imposed, are less easily explained.

5.2 Overview of Current Trade Practices in U.S. Flag Areas

Shark fin traders and their agents play a necessary and vital business role, linking fishermen with the end users in Hong Kong and elsewhere. The distinction between trader, processor, and end user can be blurred in Hong Kong, Honolulu, or elsewhere as individuals can be active in all three sectors. Of utmost importance to traders in Hong Kong is their ability to establish reliable contacts in countries where shark fins are produced. The traders in Hong Kong are typically engaged in the importation of other marine products and represent families that have been established in the business for a long time (Q. Fong, pers. commun.). In the U.S. this may also be true, as traders may be involved as end-users (restaurant owners) or play other

[42] According to the Fisheries Statistics and Economics Division of NMFS, the U.S. Customs Service uses the international Harmonized Commodity Description and Coding System (HS) to classify goods in international trade. Exporters in the U.S. must use "Schedule B" maintained by the Bureau of the Census. Shark fins are listed as category 0305.59.2000, in Section 1, Chapter 3 (NMFS Fisheries Statistics and Economics Division, pers. commun.).

intermediary roles between the initial ex-vessel purchase and the final sale of the processed product.

In the Pacific Islands, the contacts used by Hong Kong traders may be associates, agents, or independent entrepreneurs and speculators. In some locations, the local traders may have been born in Hong Kong or may have close ties there. In some cases they may be Taiwanese or, rarely, Korean, traders. Most are engaged in other businesses and conduct trade in shark fins on a part-time basis. Irrespective of a trader's ethnic background, a relatively large amount of operating capital is required as transactions with fishing vessel crews are almost always on a cash basis. As with the production of most marine products, the volumes available for purchase are never assured, and the speculative nature of the business can make it a high risk venture.[43]

Those traders operating one or two steps beyond the purchase of fins ex-vessel must be concerned with quantities accumulated for sale as well as quality. In addition to providing greater clout in the market, larger quantities provide the necessary economies in shipping and handling that are required to remain competitive.

As with many other commodities, the high risk is not without potentially high rewards. This has led to a situation in some areas where speculators are involved looking for quick profits. However, those traders who are experienced and have been involved in the business for a long time understand the risks and costs involved. The Hong Kong market is competitive, and buyers and end users are quality-conscious. Since fins are purchased in almost every Pacific location with cash, traders must first have the financial ability to participate. They then must carry the inventory and pay for storage costs until a significant amount is collected to attract a worthwhile price and better justify shipping costs. Timing in the trading of commodities is critical, and added to this is the risk of spoilage if fins are not prepared, stored, and shipped properly. Traders do not necessarily make a large profit on every transaction, and with the fall in prices over the last two years, no doubt some incurred losses.[44]

Relatively few traders or traders' agents operate in the various islands of the Pacific. In early 1999, there were three businesses engaged in part-time purchase of shark fins in Guam. Although an additional two businesses were said to have been involved in the past, these were inactive at the time information for this study was collected. There were also three businesses in American Samoa, each listing either "sharkfin processing and buying,", "sharkfin import and export," and "sharkfin processing" on business license applications submitted to the American Samoa government.

Three buyers are also said to be active in Hawaii, while one former buyer in the Northern Marianas has been inactive since transshipment in Tinian stopped several years ago. Most buyers with other business concerns do not hire additional help to handle part-time shark fin activities, but rather rely on regular employees from their other businesses to assist when necessary.

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[43] Buyers acting as agents for traders based locally or overseas can work on a commission and minimize their risk, but also limit their potential rewards.

[44] This could lead to individual traders offering less for fins now to recoup losses, and further complicate attempts to place a value on shark fins as a commodity.

5.3 The Role of the U.S. Pacific Islands and Hawaii in the International Shark Fin Trade

During the last three decades in the Pacific islands as a whole, there have been two main sources of shark fin: those collected by subsistence and artisanal fishermen and those that are collected from bycatch in commercial tuna fisheries. During the last decade a third source, directed fisheries for sharks, has increased production in a few countries.[45] In the U.S. Pacific islands (including Hawaii) only commercial tuna and swordfish fisheries produced any substantial quantities of shark fin in 1998.

5.3.1 The U.S. Pacific islands and Hong Kong

Since Hong Kong is the major market for shark fins produced worldwide, it was thought that understanding the Hong Kong trade would provide a better understanding of the role played by the U.S. Pacific islands. However, several problems exist in attempting to determine the volume of shark fins from the U.S. Pacific islands that may flow into and through Hong Kong. Some fins may not be shipped directly to Hong Kong, but through third country traders in places like Taiwan or Singapore, referred to as "secondary countries of origin".[46]

In addition to the potential for fins to be listed from secondary countries of origin, additional problems exist in identifying a more precise geographic source of fins shipped directly to Hong Kong from the U.S.. This is because the Hong Kong listing of importing countries identifies only "USA" and "U.S. Oceania."

Nevertheless, some inferences about trade in the U.S. flag areas can be made from the available trade data. For example, while Hong Kong statistics show only 300 kg as imported from Korea during January-November, 1998 it is known that the transshipments through Hawaii from Korean longliners on the high seas are significantly higher. Thus, it may be surmised that imports from the U.S. shown in the first category of Table 6 above represents the product form of unprocessed fins transshipped through Hawaii from Korean longliners, assuming no third country intermediaries were involved.[47]

Likewise, Figure 7 shows almost 14 t of shark fins as originating in Western Samoa. Although it is possible that a quantity of shark fins could have been produced by the emerging domestic small-boat longline fleet in the last several years, earlier records show over 50 t of dried shark fins (all categories) from Western Samoa entering Hong Kong in 1989 and 40 t in 1990, decreasing thereafter. Since this was at a time when there was no domestic longline fleet in Samoa, and other artisanal fisheries there would not have been capable of producing that volume of fins, the most likely explanation is that Western Samoa served as an intermediary shipment point for fins from American Samoa for either logistical or political reasons. Such factors might still determine shipment of some fins for that purpose today.

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[45] The only two countries in the Pacific islands region known to host directed shark fisheries of any size in February, 1999 are Papua New Guinea (four vessels based in Rabaul) and Solomon Islands (two to four vessels based in Honiara).

[46] The practice of aggregating smaller lots into larger ones for better advantage in the market would seem to be the major reason for this.

[47] It is also possible that the country of origin could be listed as the flag of the tanker involved in the transshipment

Table 8 lists the volumes of Hong Kong imports during the first 11 months of 1998 from these two areas, by customs category, with the percentage of overall imports into Hong Kong that they represent. A total of 71 countries are listed as points of origin for the first category; 32 countries (many the same) for the second category; with just 13 countries for the third; and only seven in the fourth category.

Table 8. Hong Kong shark fin imports from USA and U.S. Oceania, and the percentage of overall imports, excluding mainland China, January – November, 1998

	With cartilage (dried)	With cartilage (salted or in brine)	Without cartilage (dried)	Without cartilage (salted or in brine)
"USA"	287 (8.2%)	43	.152	.225
"U.S. Oceania"	10 (.28%)	-0-	-0-	-0-
Total	**297 (8.5%)**	**43 (.02%)**	**.152 (.007%)**	**.225 (3.7%)**

Units: metric tons
Source: Hong Kong Agriculture and Fisheries Department, unpublished data

5.3.2 The U.S. Pacific Islands and Taiwan

Taiwan fisheries produce a large volume of both sharks and shark products, including fins. There are significant import duties for many marine products produced by other than Taiwanese vessels. For example, the import duty for fresh or frozen shark was said to be 40% in January, 1999 (S. Chen, pers. commun.). The production from Taiwan-flagged vessels enters Taiwan duty free; however, non-Taiwan flagged but Taiwan-owned vessels and others may be able to circumvent import duty requirements for relatively high-value items such as shark fin through the use of third countries. In 1997 Taiwan imported a total of 319 t of shark, almost 70% of which was from the Philippines[48]. No imports from the U.S. were listed (Taiwan Fisheries Bureau, 1998).

It is not surprising that the total imports of raw material for shark fin processing from non-Taiwan fishery sources in other countries are not large. Taiwan has a large high-seas fishing fleet deployed world-wide, and the production of this fleet could be expected to result in relatively small import volumes from other sources. For the latest year available (1997) there were only 57.5 t of shark fins imported, consisting of 3.5 t frozen, 38.8 t dried, 6.1t prepared/ preserved, and 9.1t canned (Taiwan Fisheries Bureau, 1998). Imports of shark fin from various countries are not detailed by product form; the U.S. was listed as supplying .308 t or .5% of the total imports by weight, with no further geographic reference as to source. Hong Kong provided about 66% of imports, signifying that these were most likely fins in processed or semi-processed form.

Taiwan thus does not play a role as a destination for domestic production from either the U.S. or U.S. Pacific islands. Taiwanese fishing vessels, however, do utilize the ports of Guam as

[48]The category of sharks is different from shark fins, but is not further defined in Taiwan statistics.

a transshipment point for fins that are destined for Taiwan. Taiwanese vessels calling at American Samoa may retain fins onboard that are eventually shipped to Taiwan.

5.3.3 Hawaii

As described in Section 3, Hawaii's role in the shark fin trade is defined by the activities of two distinct fleets: the locally based longline fleet targeting swordfish and tuna, and the foreign high-seas ULT fleet that operates over a wide area of the central and western Pacific. The shark fins from the latter transshipped through Hawaii to Asia are not considered domestic production. The ULT fleet operates outside the U.S. 200-mile EEZ and the fishing vessels themselves rarely enter port in Hawaii. The catch data for these vessels are not accounted for in either the Western Pacific Regional Fishery Management Council's *Annual Report,* the NMFS Honolulu laboratory's *Annual Report of the Hawaii-based Longline Fishery,* or *Fishery Statistics of the United States.*[49]

The market for production from Hawaii's domestic fleet is sometimes assumed to be Asia; but there is another market available to fins originating in the state, one that is not captured in government trade statistics: the U.S. mainland. The market appears to be driven by the relatively large number of Asians now living in North America, a demographic change that has come about over the last 30 years. Asian immigration to the U.S. first started increasing substantially after reforms to U.S. immigration law in 1965. By the time of the 1990 census, The Asian American population had reached 7.3 million.[50] Of this number, Chinese from mainland China and Hong Kong accounted for 24%, of which almost 70% were foreign-born. Vietnamese Americans numbered almost three quarter of a million; and an additional quarter million were Taiwanese Americans, 78% of whom were foreign-born.

Although it is reasonable to assume that such a large influx of Asian immigrants could represent an increase in the domestic U.S. market for dried shark fins, either processed or unprocessed, the size of that market is difficult to define. No statistics exist for domestic shark fin production, and while the nature of the trade makes it reasonable to assume that there are both imports for domestic consumption as well as for re-export, these are not differentiated in the import data.[51] Another key undefined factor in the domestic market is the quality of fins demanded by that market. What is known is that one of the major fisheries that supply fins for domestic use has been the directed shark fishery on the U.S. east coast. The overall catch quotas for large coastal sharks have been consistently reduced, most recently almost 50% between 1996 and 1997, effectively reducing the potential domestic supply of shark fins.

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[49] The 1996 Annual Report does make mention of five Hawaii-based longline vessels with limited-entry permits that were involved in part-time activity as receiving vessels (Ito and Machado, 1997).

[50] This figure reflects legal immigration. Other sources have documented illegal immigration that would increase the total substantially. For example, Hood (1998, cited in Pan) describes the illicit immigration of from 300,000 to 400,000 Chinese from Fuzhou to the Lower East Side of Manhattan and beyond between the years 1979 and 1995.

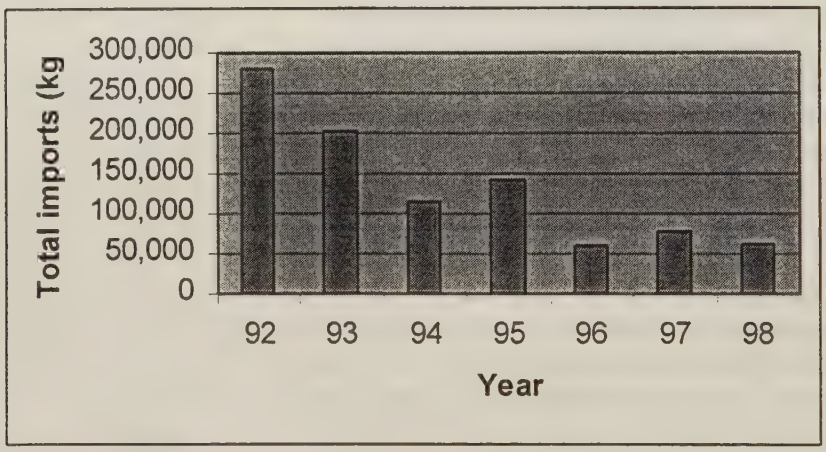
[51] As noted earlier, U.S. import statistics for dried shark fins do not contain multiple categories as those in Hong Kong; thus it is not possible to differentiate between unprocessed, partially processed or wholly processed fins.

According to NMFS, in 1998 the U.S. reported importation of a total of 62 tons of dried shark fins from 23 different countries.[52] Trade appears to fluctuate among different countries from year to year. For example, Australia led all import countries with 35% of imports by weight in 1998, after sending an insignificant amount, 1.5% by weight, in 1997. Hong Kong has been a steady supplier of dried shark fins to the U.S., most of which are probably partially or wholly processed.[53]

It is likely that fins imported from Australia were unprocessed or only partially processed, at least up to 1995, when available information at the time suggested that most exports from Australia had little or no value added (Bentley, 1998). The declared value of Australian imports were far below those for Hong Kong imports into the U.S. for the same year: $16.14 per kg for Australia, versus $40.75 for Hong Kong, indicating that the former were less fully processed.

Overall, the trend in total reported imports of dried shark fin per year into the U.S. since 1992 has been downward, as shown in Figure 8. [54] Given the cultural nature of the culinary use of shark fin in Asian communities, the relatively robust U.S. economy of the past few years, and the generally recognized increase in Asian migration to the U.S., it is unlikely that demand has fallen during this period. This provides a continued incentive for production of shark fins from Hawaii (although how much of an incentive is unclear), and may influence ex-vessel prices.

Figure 8. Total imports of dried shark fin into the U.S. 1992-1998



Source: NMFS

A further incentive to domestic production is the scrutiny by U.S. government agencies on unprocessed fins being brought into the U.S. for eventual human consumption. The government requirements and procedures required in clearing such shipments are a disincentive

[52] This volume has been questioned by one mainland trader who feels the number is under-stated, given the overall market.

[53] Declared values listed for Hong Kong in import statistics are consistently 2.5 times or more greater than those imported from Latin America, while volumes are lower (NMFS pers. commun.).

[54] Some of the reduction may be due to changes in trade patterns that historically used the U.S. as a regional import center prior to exporting to Hong Kong or elsewhere.

to importers. According to one exporter to the U.S. mainland, a sample from each shipment must first be sent to an independent laboratory for testing. While the sample is being tested, the fins must be held in bond for up to 60 days. Should the shipment be rejected on the basis of the sample, the importer has a very short time to return them to their point of origin or they can be destroyed. Samples taken for testing are not returned.

The conclusion from the foregoing is that there is a growing market on the U.S. mainland for dried, unprocessed fins, even though the size of that market eludes precise definition. While it is thought that the percentage of Hawaii-produced fins sent to the mainland is high, possibly 90% to 95% of overall production, defining that volume from currently available information is not possible.

5.4 Current Local Markets for Shark Meat

5.4.1 Hawaii

A small and apparently static market exists for shark meat in Hawaii. The only two species of shark sold through the Honolulu auction where the majority of longline fish are landed are mako and thresher. The NMFS western Pacific longline logbook summary estimates that 471 mako and 145 thresher sharks were kept in 1998. Assuming that all of these were sent to the auction, such a small number of sharks entering commerce over an entire year would not appear to be indicative of any great sustained market demand. In fact, the overall calculation of landed shark values by the Fishery Monitoring and Economics Unit at the NMFS Honolulu laboratory assumes that roughly 50% of sharks taken to the auction go unsold, with an overall average price of about $0.75 per lb. being fairly steady for the past several years (R. Ito, pers. commun.).

5.4.2 American Samoa

Interviews with several fishermen, both those with the small scale alia catamarans and those with larger vessels, confirmed that there was no significant commercial market for shark meat in American Samoa.[55] One vessel owner stated he had once tried to bring in shark (species unspecified) to sell in the local market because he knew that shark meat was often sold in Apia (in the former Western Samoa). He said that he gave up after a short time, as there were no buyers in the local market. An alia owner said he once brought in a shortfin mako because he had heard that it tasted good. He tried cooking the flesh, and agreed that the flavor was good, however he said he had no interest in trying to develop a market by bringing in more. The owner stated he had enough trouble trying to sell his other bycatch because of the competition from that off-loaded by foreign vessels in the harbor. The small capacity of alias in general as well as the danger associated with landing sharks were cited as two factors also contributing to his lack of interest in landing sharks for sale. Handicrafts seen for sale in American Samoa did not contain sharks' teeth or other products from sharks.

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[55] Although the 1997 Annual Report, Pelagic Fisheries of the Western Pacific Region (Anon., 1998) shows an average price of $1.11 per pound for shark in American Samoa, this figure is thought to be an artifact of the manner in which data was entered, and not reflective of an actual commercial market for shark meat there (D. Hamm, pers. commun.).

5.4.3 Guam

The Guam situation appears to be similar to that in American Samoa. According to its current president, the Guam Fishermen's Cooperative has tried to market shark meat in the past without success. Although it is generally known by local artisanal fishermen that shark is eaten locally and can be given away, a commercial market does not appear to exist. According to some members of the Cooperative, the vessels of artisanal fishermen are generally small, and this would hinder their ability to handle and preserve sharks properly for marketing, even if such a market existed.

5.4.4 Northern Mariana Islands

With very little shark production or apparent demand in Saipan, there has been no identifiable market for shark meat. A "Shark control and market development program" initiated in 1980-81 under the auspices of the Pacific Fisheries Development Foundation stated that shark meat was one of the main ingredients in fish cake, kamoboko, during the Japanese administration prior to World War II. One of the intentions of the 1980-81 project was to develop a local market for shark meat, and several activities were initiated including the production and distribution of recipe booklets, color posters, and decals. Shark fin soup and smoked shark meat were displayed and offered to the public at an agriculture fair in 1981, and home economics students prepared shark dishes at the high school science fair that same year. Although the report states that there was a "favorable response from those who tasted the dishes," made from shark meat provided by the project, such efforts appear to have had no impact on the overall market for fresh fish in Saipan (Anon, 1982).

5.5 Relative Value of Fins From Blue Sharks

Numerous authors such as Bonfil (1994), Lawson (1997a), and Bailey (1996), have cited the prevalence of blue sharks in the bycatch of pelagic longline fisheries in the western and central Pacific. In Hawaii, data clearly show blue sharks to be the most numerous in catch records, comprising 91% of sharks caught in 1998 (NMFS, 1999). Although there is a scarcity of reliable data from other locations, observer data from fleets active in Guam seem to confirm blue sharks as the most prevalent species caught, comprising up to 90% or more of the catch (T. Park, pers. commun.). Interviews with fishermen and those knowledgeable in the trade during the course of this project confirmed that blue sharks are far the most prevalent species captured by longline fleets off-loading or marketing shark fins in Guam and American Samoa.

Shark fin dealers and researchers familiar with the trade in Hong Kong estimate that fins from blue sharks comprise 70% of all trade there (Parry-Jones, 1996). Given the prevalence of fins from blue sharks from Hawaii, Guam, and American Samoa and the often-cited high values for shark fins in general that appear in the press or in popular accounts, it is worthwhile to review the relative value of blue shark fins in the relevant markets.

Generally, traders and published sources agree that hammerhead, in particular the dorsal and pectoral fins, are of high quality. Sandbar sharks are described by dealers on the U.S.

mainland as having high quality fins. The lower caudal lobe of mako and dusky sharks (*Carcharhinus obscurus*) are also mentioned as being of high quality (Parry-Jones, 1996).

Blue sharks are known to have fin needles of a desirability less than those from other species. The pectoral fins of blue sharks yield long fin needles, but the hair-like shape is visibly different from that found in other sharks such as sandbar or dusky sharks where the needles are much thicker.

5.5.1 Hong Kong

Hong Kong prices are important for the world benchmark they represent, given the sheer volume of trade there. The fleets in this study most directly concerned with Hong Kong prices and preferences are the high seas ULT vessels transshipping fins through Honolulu, the Japanese longliners off-loading in Guam, and both purse seiners and longliners landing fins in American Samoa.

Fong and Anderson (1998) provide attributes that were ranked in terms of relative importance to the purchasing decision by traders and processors in Hong Kong. From Fong's list, traders and processors in Hong Kong chose caudal fins, the method of cutting the fin, and the market price as among the most important attributes considered for purchase.

Lower caudals are the most valuable when they are large, due to the high percentage yield of ceratotrichia. The lower caudal fins of tiger sharks represent roughly 25% of the total weight in a primary set of dry fins. Hammerheads, particularly the great hammerhead, also possess large lower caudal fins. He lists results from the 17 respondents in his study of shark fin dealers and processors in Hong Kong who, given seven choices, ranked seven species/types in preferential order as: (1) tiger, (2) hammerhead, (3) sand bar, (4) black tip, (5) brown, (6) blue, (7) porbeagle/salmon.

Brown sharks include pelagic species such as oceanic white tip (*C. longimanus*), and silky (*C. falciformis*). Parry-Jones (1996) has remarked that blue sharks are popular by default, since they make up such a large portion of the trade. The high ranking of tiger shark is interesting, as data of indicative prices published on a biweekly basis by INFOFISH in Kuala Lumpur indicate that fins from tiger sharks ranked lower than both blue and oceanic white tip sharks.

5.5.2 Taiwan

The market in Taiwan is limited mainly to those fins produced by Taiwanese vessels such as those off-loading in Guam. A shark expert in Taiwan described high ranking fins as the large fins from silky, oceanic white tip, hammerhead, bull shark and the lower caudal fin of makos. Mid-ranked fins are those from tiger, other fins of mako, caudal fin of thresher, whale shark, basking sharks, and the smaller sized fins from the high ranked category. Lower ranked fins were those from the blue shark, smaller sizes of makos, and thresher, which is one of the least desirable as only the lower caudal is useful (G. Chen, pers. commun.).

5.5.3 North America

As noted above, the U.S. mainland and Canada are important markets for shark fin, probably because of the large and growing Asian populations in both countries. Domestically caught sharks, including those from Hawaii, supply the market as well as providing for export overseas. No estimates are available of the total volume represented by the existing North American market.

The information in Table 9 shows the various grades from one fin buyer on the U.S. mainland during the mid-1990s when prices were reportedly at their height. The grading system, based on species and fin size, is indicative of the complexity of the market, and shows the relative value of blue sharks in that market. The sizes shown relate to dry fins; however, purchase of wet fins from U.S. mainland fisheries is reported to be common as processors can better control the quality of later processing and limit spoilage. The purchase of wet fins would require slight upward adjustments to the sizes noted in the table.

Whereas the largest fins from such coastal species as sandbar, dusky, hammerhead, and tiger and the lower caudal of the pelagic mako sharks are grade A, the most common pelagic shark in Hawaii's fishery, the blue shark, ranks about midway down the scale. Actual prices paid at any given time can vary depending on a multitude of factors in the market as discussed earlier. The third column in Table 9 provides an indicative index of the various grades, relative to the top grade. The price index is calculated from prices existing in mid-1996 and omits a price for blue harks, as the trader explained they were a special category and had to be dealt with separately.[56]

Not all dealers grade or buy fins in the same manner, so Table 9 should be regarded as indicative of the value of blue shark rather than an absolute grading scale universally used in the trade. While this may represent what first-tier buyers will pay producers on a relative level, aggregate quantities may command disproportionately higher prices in the market that may not reflect the initial purchase prices.

5.6 Constraints to Marketing the Meat of Blue Sharks

There is no directed fishery for blue shark in the United States. The following discussion centers on possible utilization of sharks as bycatch in existing swordfish and tuna fisheries in Hawaii. There are four basic constraints to marketing the meat of blue sharks by existing vessels in the Hawaii-based longline fleet:

- Short storage life of the product in iced or chilled form.
- Capacity constraints of most vessels currently engaged in the longline fishery.
- Need for adequate deck space to facilitate proper handling of fresh product.
- Low value of the landed product.

[56]No further explanation was given, but prices may depend on volumes offered in varying market conditions which might offset the lower desirability of blue shark fins.

Table 9. Representative grades and relative pricing for dried shark fins, U.S. mainland, 1996

SPECIES	GRADE	PRICE INDEX	PECTORAL FIN	DORSAL FIN	CAUDAL FIN
Sandbar	A	100	>10"	>8"	>6"
Dusky	A		>15"	>8"	>8"
Tiger	A		>12"	>8"	>8"
Hammerheads	A		>10"	>8"	>8"
Mako (lower caudal only)	A		—	—	>8"
Silky	B+	87	>12"	>7"	>8"
Tiger	B+		>10"	>7"	>7"
Silky	B	70	>9"	>6"	>6"
Oceanic whitetip	B		>12"	>8"	>8"
Hammerhead	B		>8"	>9"	>6"
Sandbar, Dusky, Silky, Oceanic Whitetip	C	49	>6"	>4"	>4"
Blue*	**C**		**>16"**		
Smaller sizes of all above species, including blue, except mako	D	24	—	—	—
Mako, thresher, great white, porbeagle	E	7	—	—	—

*considered "special category" and handled separately

Source: Intertrade, Inc.

The first and third constraints relate directly to basic considerations of shark biology that must be taken into account in the marketing of meat of all sharks, not just blue sharks. Although most people know that sharks can spoil and produce an ammonia smell fairly quickly, knowing what is going on chemically can explain some of the constraints to marketing that are caused by the specific handling required to produce a usable product. Most of the following is based on Otwell, et al. (1985).

Unlike teleosts, sharks have a large amount of non-protein nitrogen compounds (NPN) such as urea in their meat as a result of possessing a more primitive kidney system and the need to increase body salt levels to survive in salt water. When a shark dies, urea is converted to ammonia by the chemical action of specific enzymes. Before spoilage begins, these enzymes must be produced by certain types and amounts of bacteria which grow on the surface of the shark. The bacteria include certain cold temperature tolerant types which will grow and produce the enzymes, even in the presence of ice.

Humans can detect a faint taste of urea in cooked shark meat when it contains a concentration in excess of 1.8%. The detectable spoilage level caused by ammonia in shark meat

is 0.03%. Thus, a portion of the urea must be removed and the production of ammonia must be prevented to assure an acceptable product.

The best method of removing NPN compounds from live shark meat is bleeding. This means that the shark must be landed alive and vigorous to enhance bleeding through cutting of the tail. A dead shark is not suitable for processing. The Canadian government's guidelines for handling and processing of blue shark state that "bleeding is the most important part of onboard handling of blue sharks" (Tavel, Ltd. and Dept. of Fisheries and Oceans, 1995). They recommend hanging the shark vertically, tail down, to hasten bleeding which can take from 5 to 30 minutes or more. Sharks must also be handled carefully, as the meat bruises easily and should not be packed under excess pressure. That means not packed deep in fish holds under excessive weight of ice and other sharks or fish.

As with all fishing, cleanliness of the deck and processing area onboard the vessel is important. However, with sharks the potential exists for contamination of urea from blood so it is even more critical that decks be kept clean, and ice not be contaminated with blood.

Subsequent to bleeding, a variety of dips or soaking solutions are necessary to extract fluids from deep in the meat to remove water soluble compounds. To produce the best product, the sharks must be dressed and processed into "logs" or trunks" as soon as possible after bleeding and initial chilling. This involves gutting and removing the viscera, removing the head and fins, and using a scraper to clean the kidney along the spinal cord.

After first cooling in salt brine (carefully, because shark meat readily absorbs salt and the meat can become tough), an organic acid such as a citric acid solution is used as a soaking medium. Properly bled and dressed sharks are placed in a tank of citric or acetic acid that is thought to neutralize the basic ammonia compounds, remove urea, decrease bacteria, and prevent enzyme activity. Careful application of this technique is required because prolonged soaking in acid can impart a bitter taste.

The condition of dressed sharks is checked with litmus paper. A pH higher than 7.0 indicates the shark was not properly bled. Any dressed sharks with a pH of 7.5 or more are not acceptable. The Canadian government guidelines state that properly bled, cleaned, and stored blue sharks can be held on ice for up to 5 days. This is consistent with information gathered during an attempt to develop a commercial blue shark fishery in California in 1980-1981. Fresh samples of blue shark meat that were refrigerated at temperatures from 33° to 36° F deteriorated after the second day, becoming unusable by the fifth day (West Coast Fishery Development Foundation, 1981). In Taiwan where fish balls are produced from fresh shark, research found that iced shark must be used "within five days after catching", but that frozen shark stored at minus 20°C was still suitable for use after up to five months in storage (Jeng and Hwang, 1978).

The most obvious constraint to retaining blue sharks onboard in the manner described is the short storage time before spoilage occurs even with proper handling. Vessels operating in the Hawaii longline fishery utilize ice for fish preservation and are generally not equipped to freeze their catch. In 1997, the average swordfish trip for Hawaii vessels consisted of 14 days fishing, plus transit time back to port from distant fishing grounds. Trips that targeted tuna in 1997 averaged 10 days plus transit time from fishing grounds that may be closer to port, but often are not.

The option may exist to refit vessels with freezer holds so that they can land a frozen rather than fresh product. Since costs of refit would be specific to each vessel, any meaningful investigation of refitting vessels in Hawaii with freezers would have to consider factors of vessel design, hull material, and machinery on each vessel concerned. However, even if vessels could be refitted with larger freezer holds to handle blue shark, such space would be at the cost of capacity reserved for the target species. With no local market for frozen blue shark, an expected high cost of shipping to existing overseas markets, and a low price in those few markets that do exist, the potential for economic benefit to existing vessels would appear to be nonexistent.

Another constraint sometimes overlooked is that although some vessels engaged in the Hawaii longline fishery may look large at the dock, their limited fish hold space and the use of ice to retain their target catch means that they are "capacity constrained." This means that they are restricted in the amount of catch, including bycatch, that they can land from any given trip, since the hold capacity dictates the amount of ice that can be taken onboard. Fishermen are not inclined to waste ice on low value bycatch, particularly in the early stages of a trip.

Some vessels that target swordfish have been equipped with salt water ice machines in recent years, and this has alleviated the capacity constraint problem somewhat. However, not all vessels are so equipped nor do the crews always have the technical capability to effect repairs at sea, an important consideration when relying on mechanical ice makers far from port.

From descriptions of handling requirements, it is also clear that at least some deck space be dedicated to the processing area for sharks, but away from locations where the target species are handled to prevent contamination. For smaller vessels, the required handling and processing areas may not be available.

Handling requirements would also appear to require the attention of the crew away from the work of hauling, cleaning, and storing the target species. With the high CPUE of sharks compared with the target species, additional crew would most likely be required just to handle sharks.

In spite of problems with the nature of the animal and the obstacles described above, markets for blue sharks do exist. A major constraint for blue sharks processed for sale in Hawaii would be that, as a landed product, the value of blue shark meat in general is very low because the value is added during subsequent processing. For example, the bycatch of blue sharks in coastal longline fisheries of northern Japan are off-loaded at Kesennuma in northern Honshu. In 1994 about 3,600 t of surimi was produced for kamoboko manufacture at a reported price of $1.60 per kg or $0.73 per lb. (Kiyono, 1996).

Japan's Tokyo Central Wholesale Market reported annual sales volume of blue sharks is much lower than Kesennuma, averaging 258 t per year from 1995 to 1997.[57] Sharks marketed there were most likely only the highest quality brought from other markets in the country. In 1997 the average sales price was 426 yen per kg, or about $1.61 per lb (Sonu, 1998). This value is not an ex-vessel value, but a wholesale auction price from which commissions, handling, transportation and other charges would have to be subtracted. These charges would depend in

[57] It is assumed that the weight represents dressed blue sharks, and that the whole weight would be closer to 200% of that, or 516 t. The trend in volume at the market during the past decade has been downward, with 1997 volume about half of that in 1987.

part on the actual off-loading location of the fishing vessel, all of which indicates a much lower ex-vessel price. The meat of blue sharks is generally used in the production of kamoboko (K. Takahashi, pers. commun.). To keep the volumes in perspective, the 54,000 blue sharks finned by the Hawaii longline fleet in 1998 would represent about 1,080 t of dressed shark, or about double the volume of blue shark sold in the Tokyo Wholesale Market during 1997.

As a protein source, there does not appear to be any hidden or extraordinary nutritional value that might be attributed to blue sharks to argue for their greater utilization and offset difficulties of bringing the animal to market. Arai and Kinumaki (1987) analyzed the meat of blue shark and found "the nutritive value of shark meat protein was less than that of ordinary fish meal, and the digestabilities (sic) of muscle lipids...were also inferior to that of soybean oil."

Another fishery utilizing blue sharks is the "ponga" fishery in Baja California. This fishery operates with small, open boats 7 to 9 meters long using outboard engines. Taking 1 or 2 day trips, maximum, these vessels operate along Mexico's entire Pacific coast and in the mid 1990s were estimated to number over 2,000 vessels. Ponga fishermen are known to retain blue sharks that other larger vessels staying longer at sea would discard. Blue shark flesh is sold fresh in markets for local consumption and transshipped to other locations in Mexico. Seasonally, temporary camps are set up in the Gulf of California where sharks are filleted, dried, and salted (Holts, et al., 1998).

It has been reported that several factories that now exist in Mexico have centralized and mechanized the salt fish production; however, little information is available on their operation other than that they accept both fresh and frozen properly prepared blue shark for processing. Ex-vessel prices paid for fillets or dressed carcasses are thought to be low by U.S. standards, in the range of $0.35 to $0.95 per kg, for fresh and frozen meat, respectively.

All of these prices compare with the average ex-vessel longline prices (whole weight) in Honolulu during 1997 of $7.08 per kg for bigeye, $5.90 for yellowfin, and $4.80 for swordfish (Anon., 1998).

Given all the above, it is clear that even if Hawaii-based vessels could land a quantity of properly bled and iced blue shark within a few days of capture, something not possible or practical given current vessel configuration and fishing patterns, accessing existing markets would be exceedingly difficult and costly. Even if the technical and logistical problems could be solved, the extremely low prevailing prices in those markets would not justify the retention of blue shark carcasses.

6. ESTIMATES OF LANDINGS AND LANDED VALUE

6.1 Estimating Landings

The term landing is used here to mean the off-loading of sharks or shark parts in Hawaii, Guam, and American Samoa. There are three basic approaches that can be taken to determine the volume of landings of sharks and shark parts, i.e. fins:

- Utilizing basic catch data as produced from log sheets, sometimes refined through observer estimates or port sampling, and applying appropriate conversion factors.
- Consulting trade data such as those concerned with exports.
- Discussing details of the trade with those persons who either closely observe or are directly involved in the industry itself.

Ideally, one or more of the three approaches could serve as a check or reinforcement of the other(s). However, problems of varying degrees are found in all three approaches depending upon the fleet in question. For example, catch data may not be available or, if available, have major deficiencies in terms of reliability and detail.

The variation in governmental monitoring of bycatch landings by the various fleets, including those of the vessels' flag states, or by regional organizations, is considerable. The least monitored is the high seas ULT fleet which transships its catch either on the high seas or in ports where there is little monitoring. Foreign longline vessels calling in Guam and American Samoa as well as U.S. purse seiners off-loading in American Samoa are subject to varying degrees of monitoring. However, in some cases the information regarding fin export remains confidential or is of questionable reliability. The best information on landings and the disposition of sharks through the marketing chain comes from Hawaii. But even here landing of the important fin component from domestic vessels is conducted in a manner that makes on-site information difficult to collect[58].

Trade data may be of an aggregate nature and not allow detailed identification of specific products, or the regulations governing the release of confidential business information contained in the data may preclude access. Recently, dependable sources in the industry have not been willing to discuss transaction details for business reasons and because of their concern over current events and publicity surrounding the shark finning issue . Thus, depending on the fleet or locations discussed, estimates of landings have been made using as much of the information from the three sources as appears valid -- an admittedly subjective approach but one that is unavoidable.

6.2 Estimating Value

In Section 5 the complexity of the trade and the lack of any real benchmark or reference prices were described. When a product or shipment is brought into a country or landed for

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[58]Upon arrival in port, captains and crews are most concerned with taking care of and offloading their catch. The actual sale of shark fins to dealers or agents can take place at any time after the vessel is offloaded.

export, it is valued and documented for customs purposes. There are sometimes sufficient incentives for importers or exporters to adjust the declared value of the product, such as when there are duties or tax considerations involved.

With no monitoring of the trade and no paper trail to follow, assigning a value or values to a volume of shark fins estimated to be landed is tenuous at best.[59] In some cases, word-of-mouth on the docks regarding prices of shark fins paid to crews may refer just to the largest or best quality fins without regard to species or quantities involved. The prices mentioned may be those offered at the outset, ones that do not take into account deductions for moisture content, excess meat on the fins, or other factors detracting from price. In some locations, there may be some value added to ex-vessel prices by preliminary processing so that fins are not always exported or sent on to the next level of trader in the same form as received from the vessel.

Important factors in determining value can be categorized as market-related or product-related. Product-related factors are mainly

- species of shark
- size of fins
- amount of water content, which is related to the time and method of drying
- manner in which the fin is cut and the amount of meat and cartilage remaining on the fin that could cause the fin to spoil.

Market-related factors that may be unique to each location include:

- destination of sale
- buyer's assessment of the current market
- buyer's expected overhead costs, including possible primary processing or cleaning and storage of fins
- buyer's past experience in the market (e.g. need to recoup losses)
- whether the buyer is purchasing on his own account or as an agent for someone else
- competition from other buyers at the same location
- experience of sellers (vessel crew or others) in selling fins

With each of these factors somewhat different among the locations in the study, and with different and perhaps unrelated buyers at different locations, the particular circumstances when fins are first sold can also be different. For example, it should not be expected that fins from a particular size or species of shark would attract the same ex-vessel price in Honolulu as they might in American Samoa at any given point in time. Also, because of the above price determinants, fins of the same size and quality offered at different times during the year would not necessarily be valued at the same price by buyers in a given location.

Even if quantities of shark fin produced by each fleet are known, all the factors listed above mean that calculating a relatively precise annual ex-vessel value for shark fins from each location is impossible. The solution employed here is to assign an ex-vessel value for 1998 based

[59] Assessing a value based on observed retail prices in Asia or elsewhere is invalid because of the large number of middlemen and processors, transportation, and other costs included in such prices.

on actual known sales or reliable price information. Because of the timing of this project, most of these reference prices are from late 1998 or early 1999. Some adjustments have been made since some known prices applied to large fins and do not consider variations in fin size or species within one lot. Table 10 shows reference price(s) used, estimated prices, and factors that most likely might contribute to determining an average price range.

Table 10. Estimated 1998 ex-vessel dry shark fin prices in Hawaii, Guam, and American Samoa

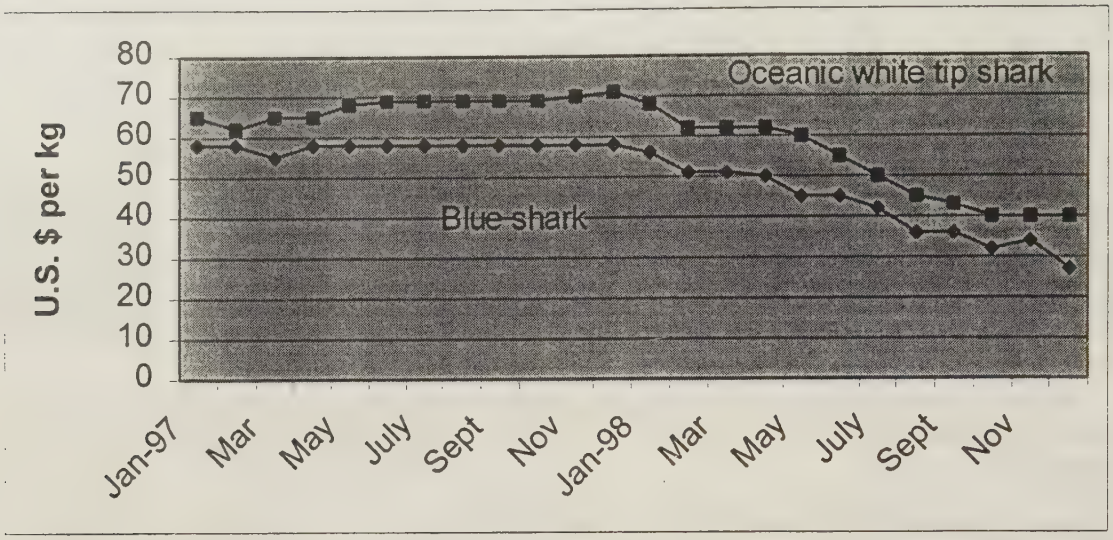
Location and source	Reference price (per kg)	Major price determinants	Average price range ($/kg)
Hawaii, local longline landings	$33 ($15/lb) for large fins; $17 ($4-8/lb others)	Mostly blue sharks. Properly cut and cleaned; multiple buyers; U.S. mainland market	$25-30
Hawaii, high seas transshipments	$17	Mostly blue sharks. Poorly cut; higher risk of spoilage, single buyer	$15-$19
Guam, Japan longline landings	$13-$15	Mostly blue sharks. Sometimes poorly cut; unsophisticated sellers, low volume	$13-$15
Guam, Taiwan longline transshipments	No reference	Mostly blue sharks. Better quality than Japan longline in Guam; domestic market in Taiwan for upper caudal	$15-$20
Am. Samoa, longline landings	$13-$15	Mostly blue sharks. Sometimes poorly cut; few buyers	$13-$15
Am. Samoa, purse seine landings	Large $35, medium, $10, small $4.50	Most higher value "brown" sharks, properly dried.	$18-$23

There are no published sources of shark fin prices or price trends in Hong Kong, the world's largest market and one that more than any other influences world prices. In the absence of any available time series depicting the price of shark fins in Hong Kong, an alternative source is the biweekly information published by INFOFISH in Kuala Lumpur that quotes Singapore "indicative" prices. These price quotes do not indicate the grade of the various species quoted; however, they are worthwhile in at least providing an indication of price trends for dried shark fins.[60]

As an example, Figure 9 was constructed using information from the INFOFISH Trade News, and gives the overall price trend for fins from oceanic white tips and blue sharks during 1997 and 1998. While there was no specific reference for the source of blue shark fins, the source of oceanic white tip fins are quoted as "SW Pacific". It should be remembered that purchase of fins from fishermen by traders may have preceded these prices by months, and that prices presented here are intended to reflect market trends and not absolute prices in other markets.

[60] INFOFISH obtains indicative price quotes mainly from Singapore traders and publishes them bimonthly. It is assumed that prices are for the highest grades.

Figure 9. Trends in indicative prices for oceanic white tip and blue shark fins, Singapore, 1997-1998



Source: INFOFISH

The drop of approximately 50% in overall price corresponds with information provided at several ports visited in the study. Either fishermen, traders, or both indicated that prices in late 1998 and early 1999 were approximately half of those received as late as 1997. This information was useful in determining current prices in ports where there was a reluctance to discuss current price information and where information on peak prices was either already available from other sources or volunteered at the time.

6.3 Some Considerations in Using Conversion Factors to Estimate Landings and Value

Because of the manner in which limited available data and information about shark catch are presented or discussed, certain conversion factors are required to interpret available data and enable some economic values to be assigned in a consistent manner. There are significant problems in not only identifying conversion factors but also in determining which factors are most appropriate for a particular situation. Some factors have historically been of greater concern to biologists than those in the fishing industry, and vice versa.[61] As an example, relatively little work has been done in the Pacific region on determining the round (whole) weight of sharks from landing data (where those sharks sold are normally landed dressed).

When some conversion factors are used, there can be additional problems caused by physical characteristics of sharks varying between species; for example, fins are of a different shape, thickness and size between some of the significantly commercial species. Within species the proportion of wet fin weight to whole body weight may differ, depending upon age of a particular animal.

[61] In some areas of the U.S., the importance of some factors in setting quotas based on catch data can make the choice of factors particularly contentious.

The manner of cutting fins also can make a difference in the wet weight, depending on how much cartilage and meat is retained on the fin. Cutting fins straight from the carcass can double the wet weight of fins, according to one trader.[62] In attempting to apply a ratio of wet to dried fins, it is sometimes not taken into account that fins from different species of shark retain different amounts of water when dried sufficiently for sale, or that the water content in a single species may vary depending on the source of dried fins and the method of drying. For example, a trader in the mainland U.S. estimates about 33% yield from wet to dry blue shark fins, while another in Japan calculates that properly cut and completely dry blue shark fins yield about 28% from wet fins.

For the purposes of this study and unless otherwise noted or where specific data or other factors are available, the conversions used are those listed in Table 11. The sources are from both within government and industry.

Table 11. Conversion factors applied to available catch and landing estimates or data to calculate volume and value of shark fins

Application	Conversion	Comments
Conversion of number of blue sharks to whole weight	45 kg per shark	Arbitrary, used when reliable observer data or other information not available.
Conversion of number of thresher sharks to whole weight	70 kg per shark	Ditto.
Conversion of number of mako sharks to whole weight	80 kg per shark	Ditto.
Dressed to whole weight (mako)	1.4	Thought to be commonly marketed with belly flaps.
Dressed to whole weight (thresher)	2.3	Can also be applied to larger bodied sharks.
Dressed to whole weight (other than mako or thresher)	2.0	Represents smaller bodied sharks such as relatively slender blue shark.
Wet fin weight as percentage of whole weight (blue shark)	.045	Based on information from Japanese traders who say wet fins represent 9% of dressed weight for blue shark.
Wet fin weight as percentage of dressed weight (mako)	.05	Based on information from Japanese traders.
Dry fin weight as percentage of wet fin weight (blue shark)	.33	Can also apply to thresher, although only lower caudal is valuable.
Dry fin weight as percentage of wet fin weight (oceanic white tip and silky, mako)	.42	Less water loss on drying than blue shark.

[62] Although the crescent-shaped "moon cut" is preferred for most fins, the lower caudal is usually cut straight to retain the greatest amount of fiber.

6.4 Domestic Longline Vessels in Hawaii

Hawaii longline vessels are required to report their activities on the NMFS Western Pacific Daily Longline Fishing Log. The log sheet requires sharks to be recorded in four categories: blue shark, mako shark, thresher shark, and other (specify). In each of the categories sharks are recorded as "kept" or not "kept/released". For kept sharks, the total catch for that set must list the total number "fins only," or "kept whole."

6.4.1 Shark Fin Volume

From the logbook information described above, the reported number of sharks finned is calculated. In 1998 that number was 58,444, consisting of 53,822 blue sharks, 579 mako, 1,357 thresher, and 2,686 "other." Using factors from Table 11 above, this number of finned sharks represents a volume of about 38 t in total of dried shark fins, with fins from blue sharks comprising 95% of the total volume, mako sharks 2%, and other sharks 3%. With only the lower caudal fin of thresher sharks possessing any market value, they were not considered in this calculation.

6.4.2 Shark fin value

Because of the apparent reliance on markets in the U.S. mainland rather than Asia, the price of fins may not directly reflect price levels in the latter at any one time. However, the international nature of the market forces prices to follow the same trend as supplies move worldwide. This is apparently what has happened in the last few years as prices rose throughout the early 1990s and peaked on the U.S. mainland during 1995. They stayed fairly constant for about two years until the influences of the Asian economic collapse were felt in this market during late 1997 and into 1998 (R. Hudson, pers. commun.). In Hawaii, during the period of highest prices top grades were said to be $28 to $30 per pound ($61-$66 per kg), ex-vessel, at their peak (M. Lau, pers. commun.). From this and from discussing current sales in early 1999 with fishermen, a value of $25 to $30 per kg is estimated for fins produced by the Hawaii longline fleet in 1998.

6.4.3 Shark Meat Volume and Value

Longline captains in Hawaii contacted during the course of the study indicated that only mako and thresher sharks are retained for sale. The latest published information estimating the volume and value of shark sold in Hawaii is for 1997 (Anon., 1998). However, that information aggregates estimated fin value with shark meat sales value to obtain an overall revenue figure for the year of about $2 million. In 1998, 471 mako and 145 thresher sharks were kept by the fleet. If it is assumed that all these sharks retained by longliners were marketed using estimated weights ar .onversion factors from Table 11, the total dressed weight retained would be on the order of 31 .00 kg: 27,000 kg mako and 4,500 thresher. According to the NMFS Honolulu Laboratory's Fis ry Monitoring and Economics Unit, the average value for mako and thresher sharks sent to the auction in Honolulu was $1.34 - $1.40 per kg in 1998. This figure that has not changed very

much over the last several years. Based on these figures, the 1998 ex-vessel value of shark meat in Hawaii is about $42,000.

6.5 High-Seas Longline Vessels Transshipping Shark Fins Through Hawaii

6.5.1 Shark Fin Value

Information on the value of shark fins purchased from high-seas longliners and transshipped in Hawaii is not readily available. The actual transaction takes place on the high seas and the only statement of value is that on Customs import forms. One such shipment in early 1999 declared a value of $20 per kg (Anon., 1999). This value is assumed to be CIF, although available documents do not give any further indication. While it is recognized that there may be reasons for either over or under-valuing the shipment as discussed earlier, this information represents the only knowledge of fin value for these transactions and is used here. Estimated FOB value of fins obtained on the high seas would involve estimating freight to port and other costs incurred by the trader. For discussion here, those costs are estimated to be $2 per kg,[63] giving a range of $18 to $20 per kg.

6.5.2 Shark Fin Volume

As described in Section 3, the Korean high-seas fleet is the main participant in the fin trade taking advantage of transshipment through Hawaii. Although most or all sharks caught and brought aboard the vessels are assumed to be finned, complete and reliable bycatch data of the Korean fleet Pacific wide are not available. For the years 1990-1997 the average annual total catch in the statistical area of the South Pacific Community for this fleet was estimated to be around 30,000 t. Of that amount, from 1990-1997 approximately 12% annually, or 3,600 t was said to consist of "others." No breakdown of this others category was available (SPC, 1998) however, following reporting of other nations, it most likely includes sharks. Figure 10 shows that bigeye is the predominant species during this decade, indicating the targeting of deeper swimming tunas.

Available catch data help little in determining the level of shark bycatch by the Korean high-seas longline fleet in the Pacific. While the catch of "others" reported by Korea increased 89% from 3,566 t reported in 1996 to 6,744 t in 1997, it is not known if this was a result of better coverage in the reporting or a true increase in bycatch. Effort, measured in the number of hooks, actually decreased 7% from 73.4 million hooks in 1996 to 68.2 million in 1997 (Park, 1998b) [64].

No observer information is available from this fleet. The Korean government does not operate a formal observer program, but has carried out a program of "irregular on-board scientific trips" since 1991 (Park, 1998a). Only three such trips were taken, and the results have evidently not been published. There is thus little data on which to base an estimate of shark

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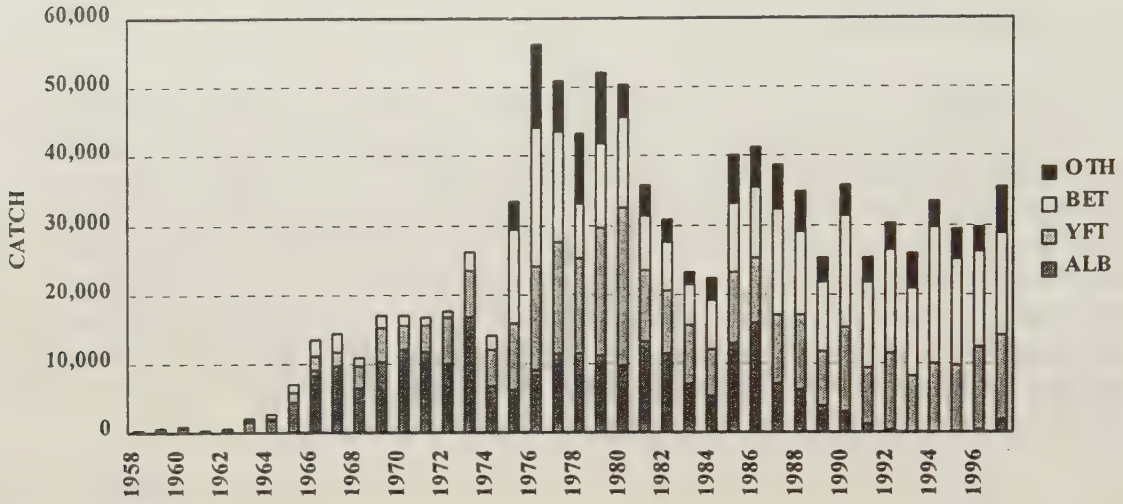
[63] See the discussion in Section 8 for estimated overhead costs.

[64] As a measure of the fleet's fishing effort, consider that the total effort by an estimated 135 to 150 vessels in 1997 was around 68 million hooks, while the 115 U.S. vessels that participated in the Hawaii-based longline fishery in 1998 set around 17 million hooks.

bycatch on Korean ULT vessels as a means of determining the volume of fins that might be produced.

Figure 10. Catches (metric tons) of albacore (ALB), bigeye (BET), yellowfin (YFT) and other species (OTH) by distant-water longliners of Korea in the SPC statistical area.
(source: Oceanic Fisheries Program, SPC)



Given the lack of information available on this activity, the method used to calculate the estimated volume of fins transshipped through Hawaii was to rely on the public news reports of approximately 11 tons that were brought to Honolulu by the Honolulu-based fishing vessel *Two Star* in January 1999. Subsequently, several responsible vessel operators were asked to estimate how many trips might have been taken by Honolulu-based vessels in 1998 for the same purpose. Since it was estimated that such a transshipment occurred about once per month during 1998, a total of 132 tons for the year is estimated.

6.6 GUAM

The total landings and estimates of landed value for sharks in Guam comprises three components. The first is the shark fins landed by Japanese longliners calling at Guam to transship sashimi-grade tuna. The remaining two are the wet (frozen) shark fins and dressed shark carcasses that are landed in Guam by Taiwanese longliners for transshipment to Taiwan by refrigerated container. During the period 1995-1998, 13 observer trips onboard Japanese longliners by MMA observers found that of 906 sharks caught, only 13 or 1.4% were retained onboard. It is assumed that retention was for meat, probably for the crew's use (T. Park, pers. commun.).

Japanese and Taiwanese longliners transshipping in Guam conduct fishing operations in one or more jurisdictions of the western Pacific as well as at least a portion of the high seas. Since there is no legal fishing in the U.S. EEZ by these vessels, no catch or landing data are collected or maintained on Guam, nor is there a port sampling program in place that might provide an indication of landings and species composition. Export data is collected as Customs and Quarantine require a shipper's export declaration and invoice if the declared value of an

export shipment is over $2,500 and is going to a foreign country. Details of such shipments are confidential. In 1998 there were 15 separate shipments containing sharks or shark fin. While details, including quantities, are unavailable, the destination of the cargo as shown in Table 12 provides a picture of export activity from Guam.

Table 12. 1998 Export shipments from Guam containing shark fins

Date	Commodity	Destination
February 12	Sharks & frozen fish	Taiwan
March 3	Shark fin	Japan
April 30	Shark fins	Hong Kong
May 14	Shark fins, frozen fish	Taiwan
May 19	Frozen fish ("mostly skipjack") shark fins	Taiwan
July 14	Shark fins & others	Taiwan
August 4	Shark fins & others	Taiwan
September 2	Shark fins & others	Taiwan
September 18	Shark fins & others	Taiwan
September 29	Shark fins & others	Taiwan
October 29	Shark fins & others	Taiwan
November 11	Shark fins & others	Taiwan
November 18	Shark fins & others	Taiwan
December 20	Shark fins	Hong Kong

Source: Guam Dept. of Commerce

Shipments to Taiwan are in freezer containers, while shark fins sent to Hong Kong are in dry containers. Not enough information is available to explain the one shipment of shark fins to Japan.

During the years 1995 to 1998 observers from the Micronesian Maritime Authority took 15 observer trips in the western Pacific on Taiwanese longliners operating in FSM. While information from these trips provides information on general practices aboard the vessels, there is little information available in observer records that might provide insight into the volume of shark fins collected. The same can be said for the 13 observer trips taken on Japanese longliners mentioned above[65].

Because of the small number of observer records and the lack of detailed observer catch data, the knowledge of experienced vessel agents, shark fin traders and others in Guam was used to estimate volumes of shark fin and meat off-loaded in Guam. For Japanese longline, this was estimated to be from 20 to 30 kg of dried fins per trip and for Taiwanese longliners from 200 to 250 kg of wet fins per trip.

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[65]The lack of detailed data collection relating to sharks reflects the emphasis in the MMA (and probably some other national observer programs in the central and western Pacific as well) on obtaining information primarily on the tuna portion of the catch. More recent emphasis on bycatch by regional organizations such as SPC has begun to change these practices.

With a generally transient pattern of operation determined by access to available fishing grounds and periodic returns to home ports in Japan and Taiwan, overall port arrivals for these two fleets were chosen as the best indicator of activities aimed at landing or transshipping shark fins for both fleets, and dressed carcasses by the Taiwanese.

6.6.1 Longliners from Japan

6.6.1.1 Shark Fin Volume

Vessels targeting sashimi-grade tuna for transshipment in Guam retain shark fins from an undetermined amount of sharks caught incidentally during fishing operations that target tuna. The shark fins are cleaned and dried in the sun during the voyage and are sold as dried fins to either agents of traders or directly to the traders themselves upon arrival in Guam.

From January to September 1998 there were 926 Japanese longline entries into the port, for an annualized number of 1,236 in 1998. It is assumed that 75% or 927 of the entries were for off-loading. The remaining 25% is assumed to be by vessels in transit, to pick up or drop off non-Japanese crew, for repair, or other reasons other than off-loading. Using the figure of 20 to 30 kg per trip of dried fins sold in Guam, it is estimated that in 1998 the total of dry fins sold in Guam was from 18 to 28 t.

6.6.1.2 Shark Fin Value

Prices paid to fishermen aboard Japanese longline vessels in Guam appeared to be somewhat lower than prices prevalent in other ports in the study. Reasons for this are not clear; it may be because at the time of the study there appeared to be only one major dealer purchasing for export to the Hong Kong market.[66] It may also be that the fins seen on several vessels in port seemed poorly cut with quantities of meat and cartilage still attached. These may have required additional processing before being sent to Hong Kong. Also, since the small size of the longliners make it difficult to dry fins in the engine room, the sun-dried fins may be of inferior quality to those landed in other ports.

Interviews with a major shark fin dealer, vessel agents and several fishermen working aboard Japanese longline vessels in early 1999, indicated that the general price of dried fins was in the range of $10 to $13 per kg.[67] The average per trip income for crew members as a group would thus be from $200 to $390, and the overall yearly production of the fleet would have an ex-vessel value of $185,000 to $364,000.

6.6.2 Longliners from Taiwan

6.6.2.1 Shark Fin Volume

All fins are stored onboard the vessels with the frozen bycatch, and are either shipped or taken back to Taiwan as described in Section 3. During the transfer process from vessel into the

[66] The dealer indicated that prices in 1997 and before had been twice the current level.

[67] There was no distinction between blue and brown sharks in defining the pricing.

container, species are separated and weighed, with an accurate tally kept for each species and shark fins for the vessel owner. Sharks are not separated by species, but are tallied together in one category. The contents are typically declared as "frozen shark fins and others," or similar designation with no breakdown. There were ten such shipments during 1998.

From January to September 1998 652 Taiwanese longline entered into the port for an annualized number of 868 entries in 1998. It is assumed that 85% or 738 of the entries were for off-loading of fish for transshipment. The remaining 15% were entries into port by vessels in transit, for repair, or reasons other than off-loading. Using the figure of 200 to 250 kg of wet fins per trip, it is estimated that there could have been from 147 to 185 t of wet fins brought to port, equivalent to about 50 to 60 t of dried fins.

If a typical vessel completed an average of seven trips before transshipping bycatch back to Taiwan from Guam, the amount of fins collected for shipment would range from 1400 to 1750 kg.[68] With one 20-foot container per shipment and each container holding the combined bycatch and shark fin from one vessel, it is estimated that a total of around 14 to 18 t of wet shark fin (4.8 to 6.1 t dry fin equivalent, assuming 90% of the sharks finned were blue sharks) may have been transshipped in this manner during 1998. This represents an estimated 8% to 12% of the total shark fin produced by Taiwanese vessels arriving in Guam for off-loading in 1998. The remainder was either held on board and taken to Taiwan when the vessels returned there, or transshipped elsewhere.[69]

6.6.2.2 Shark Fin Value

The ex-vessel value of wet shark fins off-loaded in Guam for transshipment to Taiwan is difficult to assess, given that all contact with buyers and the actual financial transactions take place exclusively in Taiwan. In addition to the usual problems in interpreting import statistics, those published by the Taiwan Fisheries Bureau appear to relate to imported processed or value-added fins. In comparison with the fins produced by the Japanese longliners in Guam, it may be assumed that a better product is produced by the Taiwanese, as the proceeds go to the Taiwan crew (which may include the owner/operator) and not the Indonesian or Filipino crew working onboard the vessel. The Taiwanese vessel owners apparently have no interest in selling fins to buyers on Guam, an indication that prices they receive in Taiwan are higher. Applying these two factors to the values used for fins from Japanese longline vessels on Guam, Taiwanese fins are valued from $15 to $20 per kg.

6.6.2.3 Shark Meat Volume

Sharks that are intended for return to Taiwan are dressed, frozen, and stored onboard the vessel with other bycatch. The options for shipping or carrying back shark carcasses to Taiwan .

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[68] A typical Taiwanese longliner was observed in Guam transshipping a total of 50 bags of frozen fins, with weights ranging from 25 to 28 kg each, for a rough total of around 1,250 to 1,400 kg. Stevedores performing the work remarked that this was about average for vessels of this type.

[69] Transshipment of bycatch and shark fins by Taiwanese vessels has taken place in various Taiwanese bases operated in islands of the FSM and Marshall Islands in the past. Shipment was via the Ting Hong company's refrigerated vessel that delivered bait supplies and returned bycatch and frozen shark fin to Taiwan. During one 16-month period in Majuro, Ting Hong reported to the Marshall Islands government that they exported 13 t of shark fin as well as 746 t of "frozen rejected fish and bycatch."

that are retained for meat are the same as for frozen shark fins, and in 1998 are assumed to be off-loaded in Guam for transshipment in the same proportion as fins: 8% to 12%.

The volume of shark meat retained by Taiwanese vessels is difficult to determine from available data. Because sharks are the lowest value among all stored bycatch, only a few species are retained, the most common of these are identified by agents in Guam as being oceanic white tip and silky sharks. Blue sharks are said to be retained only on the last few sets before the vessel returns to Taiwan, and only then to fill unutilized freezer hold space.

Observer reports from the Micronesian Maritime Authority covering 15 trips during the years 1995-1998 indicate that 31% of a total of 1,628 sharks captured were retained. It can be inferred from the practice of longliners that many of the discarded sharks were blue sharks. Region-wide data analyzed by SPC indicates that approximately 30% of the total catch of off-shore Taiwanese longliners were sharks with 45% of those identified as blue sharks. An additional 8% were classified as "shark" (Lawson 1997a).

In lieu of any definitive data, the estimate of shark bycatch retained is based on discussions with knowledgeable agents in Guam who estimated annual retained total bycatch of all species by a typical Taiwan longliner to be around 30 t. Of this amount, it is estimated that approximately 15%, or 4.5 t, is shark. Using the same number of trips per annum as in the calculation of fin production means that about 640 kg of dressed shark per trip were produced. Employing the same adjusted annualized number of port entries --738-- for the fleet as used above, it is estimated that about 472 t of shark carcasses entered the port, and 38 to 56 t were transshipped to Taiwan by freezer container.

6.6.2.4 Shark Meat Value

Bycatch including sharks and fins that are shipped from Guam by refrigerated container are destined for the port of Kaohsiung. There the bycatch is sold to wholesalers who handle the shark meat along with other bycatch.

Shark meat is mainly utilized in the production of "fish balls," from a surimi-like fish paste product that is often fried like tempura and eaten extensively in Taiwan as a relatively low cost and popular protein food. Lower value species of fish in addition to sharks can be and are used; however, since only fish with low fat content can be utilized in the production of fish balls, sharks (most have from 6% to 8% fat content) are particularly suitable.

The value of the market for bycatch in Taiwan to Taiwanese vessel owners is its stability, and not necessarily just the value of the species marketed. While supply and demand, currency fluctuations and other factors all tend to make the sashimi market in Japan highly volatile on a daily basis, the market for longline bycatch (marlin, mahimahi, wahoo, sharks and others) is said to be relatively stable. From 1995 to 1997 the mean FOB price for large sharks[70] landed in Kaohsiung remained steady at about NT$19/kg (Taiwan Fisheries Bureau 1996 and 1998).[71] An owner can therefore be assured more or less of a guaranteed return from the bycatch portion of his catch and plan the vessel's activities accordingly. The value of NT$19,000 per t (US$530 per t) is used to estimate the value of the estimated 38 to 56 t shark landed in

[70] Values shown are for dressed shark trunks, presumably frozen.

[71] Several people in the industry stated that prices are most likely understated in the government statistics because of the way market taxes are assessed.

Guam for transshipment to Taiwan by refrigerated container in 1998. That value is estimated to have been about $20,000 to $30,000. A further estimated 416 to 434 t was either held on board and taken to Taiwan when the vessels returned there, or transshipped elsewhere.

6.7 AMERICAN SAMOA

6.7.1 Purse Seine Vessels Off-Loading in American Samoa

6.7.1.1 Shark Fin Volume

Most U.S. purse seine vessels deliver their catch to canneries in American Samoa (Coan et al., 1998b). The South Pacific Regional Purse Seine Logsheet is required to be filled out daily by all captains on vessels fishing pursuant to the multilateral tuna treaty between the U.S. and the FFA countries. The logsheet contains an area to list discards; however, they must be listed by the captain under the discard heading "other species," The form asks for the number of these other species and an estimated weight. Unlike Hawaii, where the capture and disposition of sharks caught incidentally to longline operations by U.S. flag vessels are required to be detailed on the logbook form, U.S. purse seine vessels have no such requirement. The forms used in the collection of catch and effort data by U.S. purse seiners, the Regional Purse Seine Logbook, developed by the SPC and administered by the FFA, require discards to be recorded as either "tuna species" or "other species," with the latter requiring a name, number and weight.

All or almost all sharks caught in tuna purse seining are discarded at sea. There is no market in American Samoa for shark meat and shark is not used for food onboard.

The FFA operates an observer program in conjunction with the multilateral treaty. Observers record information from fishing operations on the South Pacific Regional Observer Set Details form. This form requires five separate shark categories to be identified:

- Silky shark
- Blue shark (also identified as blue whaler following Australian nomenclature)
- Oceanic white-tip shark
- Silver-tip shark
- Sharks (unidentified)

Using observer data, Bailey (1996) ranked bycatch species by their occurrence in purse seine sets on different school associations. Table 13 enumerates the most common species of sharks and rays caught as bycatch, with R = rare or <1/set, S = common in small numbers, 1-10/set, M = common in moderate numbers, 10-100/set, L = common in large numbers >100/set, and — = not present.

Table 13. Bycatch species from purse seine sets on different school associations in the western tropical Pacific

Species	Unassoc. School	Log	Drifting FAD	Anchored FAD	Live whales	Dead whales	Whale shark
Blue shark	—	R	—	—	—	—	—
Oceanic whitetip	S	S	S	S	S	S	—
Silky shark	S	M	M	M	M	M	—
Tiger shark	—	R	—	—	—	—	—
Whale shark	—	R	—	—	R	—	S

Source: Williams (1996) and Bailey (1996)

The information contained in Table 13 conforms to information obtained from one captain and crew in American Samoa who indicated that when sharks were captured, oceanic white tip sharks and silky sharks were the most commonly caught species in purse seine fishing.[72]

The percentage of sets by U.S. purse seiners on free-swimming schools (identified in Table 13 as unassociated schools) in the past has consistently been around 80% of the total number of sets. Since 1995 there has been a significant trend towards a greater number of sets on drifting objects. In 1997 sets on drifting objects surpassed those of sets on free-swimming schools for the first time, with 59% recorded as being on drifting objects (Coan et al., 1998b). This may have implications for the number of sharks captured by purse seiners; however, anecdotal evidence from crews and those involved in the shark fin trade in American Samoa suggests that there has not been a great increase in the volumes of shark fins brought in by purse seiners over the past 3 years.

In 1997 the U.S. purse seine fleet reported shark bycatch of 145 t in the Regional Purse Seine Logbooks. Sharks represented about 16% of all recorded bycatch and discards in 1997 (Coan et al., 1998). It is probable that the total level of shark bycatch is underreported, given the preoccupation of captains with fishing operations and the handling of the target species. There were 169 port arrivals in American Samoa during 1998. Allowing 10% for aborted trips occasioned by calls for repairs, 152 port visits could have resulted in shark fin sales, or an average of about 950 kg of sharks caught per trip. Using an assumed weight of 45 kg per shark would mean about 21 individual sharks captured from each trip. Even considering that about 60% of trips were on drifting objects as reported by Coan, the numbers of sharks in the two main species noted as bycatch per set from drifting objects from Table 13 above would indicate larger numbers of sharks being caught overall.

If all sharks reported to have been captured in 1997 were finned, and all were either oceanic white tip and silky sharks where wet fins equal approximately 5% of whole body weight,

[72] However, a Taiwanese former shark fin buyer interviewed claimed that almost all fins purchased from purse seiners were oceanic white tips.

about 20 kg of dried fins would have been produced from each trip. However, anecdotal evidence collected from those in the fishery suggests that even with the price having dropped, the average amount of fins landed per trip is much higher.

According to some involved in the fishery, when prices were high more crew would be involved in the finning and, depending on the number of sharks caught incidentally to fishing operations, up to 200 kg of dried fins could be landed from a trip. However, in recent years with the price having dropped, the average amount is said to be closer to 60 or 70 kg. If this range is used, the overall annual production of dried shark fins would be from 9.1 to 10.6 t.[73]

6.7.1.2 Shark Fin Value

The value of shark fins was determined through conversations with traders as well as those employed on purse seiners and familiar with prices current in late 1998 and early 1999. The traders mentioned that fins from purse seiners, estimated here to be roughly $18 to $23 per kg overall, were of higher quality (both in manner of drying and of a more valuable species) than those from longliners and would attract a price 20% to 50% higher than that paid for fins from the Taiwanese longliners that called in American Samoa. In February 1999 ex-vessel prices paid (after some negotiation) in one sale were $36 per kg for large fins, $10 per kg for medium sizes, and $4.50 for smaller fins.

6.7.2 Longline Vessels Off-loading in American Samoa

Longline vessels calling at American Samoa consist mainly of Taiwanese vessels.[74] The Taiwanese vessels call at American Samoa for several reasons: vessels targeting albacore off-load at the canneries while some ULT vessels transship in the harbor to carriers, discharge bycatch, and obtain supplies.

6.7.2.1 Shark Fin Volume

With the presence of shark fin traders in American Samoa, all port calls offer an opportunity to sell shark fins. This does not necessarily mean that all vessels will off-load all shark fins in American Samoa at every port call. Other ports, mainly Papeete and Levuka, may offer better prices, or they could be sold to transport vessels on the high seas.

Employees of the Customs and Excise Tax Division indicated a large problem in monitoring shark fin off-loadings from the various vessels that called in port. There is a 5% duty levied on the sale of shark fins; and this, among other reasons, was cited as encouraging circumvention of Customs procedures. During fiscal year 1998, the total duty collected from the

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[73] This figure may have been slightly less in 1998. Observer reports of bycatch for U.S. tuna seiners reported shark bycatch in 1998 of approximately 56 t (Coan, et al., 1999). Extrapolating from the observer coverage of 20%, it is conceivable that the total shark catch was around 280 t. If all sharks were finned, using the conversion factors above, 8.1 t of dry shark fins would have been produced.

[74] 1992 marked the end of any significant Korean presence in the albacore longline fishery, after about 10 vessels were tied up and an additional 9 were stranded on the reef and lost during a hurricane in late 1991.

sale of shark fins was $3,522.50, an amount that would indicate a total declared value of $70,440. Even at a nominal value of $12 per kg, the total would amount to only 5.8 t or about 24 kg per vessel during a period when 104 port calls were made by longliners and 133 port calls by purse seiners.

A shark fin trader knowledgeable about the Taiwan longline fleet's activities and the shark fin business in American Samoa indicated that all Taiwanese longliners in the south Pacific fishery produced a total of about 35 t of fins (dry weight) last season. (See Table 4 in Section 3 for a description of seasonality in the fishery). The Taiwan Tunaboat Owners and Exporters Association estimates there were about 70-80 vessels operating, so each vessel might have produced around 450 to 500 kg during a six-month season. Using these figures and given time spent in port, the overall production of the fleet on an annual basis in 1998 could have ranged between 53 and 69 t.

Not all vessels called in American Samoa after every trip, with some going to Tahiti or Fiji for off-loading and resupply. Therefore, the entire production of fins from the fleet would not necessarily be marketed in American Samoa. Assuming that 80% of the port calls at the conclusion of trips are made in American Samoa, the total annualized shark fin production for vessels calling there in 1998 is estimated to be in the range of 40 to 52 t.

The situation is clouded by figures provided by the American Samoa Customs and Excise Tax Division that showed 27 t of shark fins listed as "outbound" in compilations taken from vessel clearance forms during 1998. This was explained as the volume of shark fins retained on board vessels while in port and taken out of the Territory, not exports of fins landed from those vessels. There is no indication of whether or not they were wet or dried fins or if in fact they were actually sighted on departure or simply claimed to avoid taxation. Customs officers believed that there may be significant "leakage" of fins ashore, given the difficulty of policing the vessels 24 hours per day. They claim that the relatively recent practice of storing wet fins in fish holds rather in a dry locker that can be more easily sealed by Customs during the duration of a vessel's stay in port has compounded their problem of identifying and monitoring the volume of fins onboard.

Given the fact that the practice of retaining such fins was linked by Customs to storage of the fins in fish holds, it is assumed that all such declared "outbound" fins are wet, and that only 50% are actually taken out of American Samoa. Using a wet to dry fin adjustment of 40%, it is estimated that an equivalent of 5 tons of dried fins are not landed from vessels entering American Samoa, thus reducing the overall fleet landing estimate to about 35 to 47 t.

6.7.2.2 Shark Fin Value

Little information was available in American Samoa relating to ex-vessel value of shark fins purchased from the longline fleet. As mentioned above, collections of duty on shark fins are probably not indicative of either price or volume. However, given the price information for fins purchased from purse seine fishermen and from descriptions of the higher prices paid by traders for those fins, it is assumed that prices in 1998 ranged from $13 to $15 per kg on a dry fin weight basis.

6.7.2.3 Shark Meat Volume and Value

In addition to shark fins, some longliners also off-load their miscellaneous bycatch, including sharks, into cold storage space rented from the canneries. This bycatch is transferred back to Taiwan either by refrigerated carrier or by freezer container. Not all vessels off-load their bycatch for storage, and the volume is thought to be relatively small. The vessels that primarily utilize this method of bycatch storage at one cannery are the remaining four Korean albacore longliners.

The difference between shark bycatch sent back to Taiwan from American Samoa and that sent from Guam is that only mako sharks are retained and shipped from American Samoa, whereas shipments originating from the fresh sashimi vessels in Guam include oceanic white tip, silky, and perhaps some others. According to Taiwanese vessel captains interviewed in American Samoa, makos are retained because they are the highest valued of the sharks caught, although they are a small percentage. Storage space aboard is a consideration in retaining or discarding sharks at sea, as is the cost of shipment from American Samoa.

Although mako sharks captured and frozen by Taiwanese longliners are the most valuable in the Japanese market, the method of handling in American Samoa, frozen dressed, would seem to indicate the destination may not be Japan directly. There frozen fillets are a common product form received from Japanese ULT vessels overseas and may be of higher quality.[75] It is thus assumed that the destination for frozen sharks stored ashore is Taiwan, and the same value, $530 per t is used as that for Guam.

Discussions with Taiwanese in the industry indicated that the annual bycatch handled in this manner in American Samoa was probably around 300 to 400 t in recent years, with sharks making up from one-third to one-half of the total.[76]

6.8 SUMMARY

6.8.1 Shark Fins

The amounts in Table 14 summarize the landing information for shark fins presented by fleet for each location discussed in the preceding sections.

Table 15 summarizes the information on volume and value by national affiliation (not necessarily flag) of vessel and landing location. Shark fins produced by U.S. flag vessels represent 19% of the estimated total volume and from 25% to 26% of the estimated total value of all fins landed in the three locations.

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[75] This product form was mentioned in a Japanese trade paper as attracting a price of around 250 yen ($2.08) per kg at the Tokyo Wholesale Market in December 1998.

[76] Although volumes stored and exported in this manner are reported to authorities, data cannot be released for confidentiality reasons.

Table 14. Estimates of volume and ex-vessel value of shark fins landed in Hawaii, American Samoa and Guam, 1998

Location and source fleet	Estimated volume (dry fin weight)	Average price range ($/kg)	Estimated range of ex-vessel value ($'000)
Hawaii, local longline	38 t	$25-30	$950-1,140
Hawaii, high seas transshipments	132 t	$18-20	$2,376 - $2,640
Guam, Taiwan longline transshipments	5 - 6 t	$20-$30	$100 - $180
Guam, Japan longline	18 – 28 t	$10-$13	$180 - $364
Am. Samoa, longline	35 – 47 t	$13-$15	$455 - $705
Am. Samoa, purse seine	9 – 10 t	$18-$23	$162 - $230
TOTAL	**237 – 261 t**		**$4,223- $5,259**

6.8.2 Shark meat

Shark meat is a much smaller trade than fins. In Hawaii, a small number of mako and thresher sharks, 616 or 0.6%, were reported as kept out of over 97,000 sharks caught in 1998. Sharks retained for their meat and off-loaded in Guam for transshipment by Taiwanese longliners are mostly oceanic white tip and silky sharks, although any mako caught would also be retained. Sharks retained for meat and off-loaded in American Samoa by Taiwanese longliners are most likely all mako sharks. They represent an unknown portion of those retained for transshipment, as some may be transshipped directly to ULT carriers either on the high seas or in port, and not be stored ashore for later transshipment.

Table 15. Estimated percentage of total volume and value of shark fins off-loaded in U.S. flag areas of the Pacific, 1998

Location and source fleet	% estimated total volume	% estimated total value
Hawaii, local longline	15%	21% - 22%
Hawaii, high seas transshipments	51%	50% - 56%
Guam, Taiwan longline transshipments	2%	2% - 3%
Guam, Japan longline	8% - 11%	4% - 7%
Am. Samoa, longline	15% - 18%	11% - 13%
Am. Samoa, purse seine	4%	4%

Table 16 summarizes estimates of both volume and value for shark landed during 1998.

Table 16. Estimates of volume and ex-vessel value of shark landed in Hawaii, American Samoa and Guam for meat, 1998

Location and source	Major species landed	Estimated landings (t, dressed weight)	Estimated ex-vessel value
Hawaii domestic longliners	Mako, thresher	31	$42,000
Taiwan longliners in Guam	Oceanic white tip, silky, mako	38 – 56	$20,000 - $30,000
Longliners in American Samoa	Mako	100 – 200	$53,000 - $106,000
TOTAL		**151 – 269**	**$115,000 – $178,000**

Of the three fleets known to be involved in retaining and landing at least some shark meat, Hawaii-based longliners, American Samoa-based Taiwanese longliners, and Guam-based Taiwanese longliners, the U.S. flag vessels land the least. Only sharks landed in Hawaii, 11%-20% by volume and 24%-36 % by value, were sold in the U.S.. Those landed in Guam were transshipped back to Taiwan by refrigerated container with other bycatch, while sharks landed in American Samoa were stored onshore until similarly shipped.

7. THE IMPORTANCE OF INCOME FROM SHARK FIN SALES TO VESSEL CREWS

From information gathered during the course of the project it is clear that with the exception of the Guam-based Taiwan longliners, fishing vessel crews are the main recipients of ex-vessel revenue from the sale of shark fins. Guam-based Taiwanese crew apparently benefit although non-Taiwanese may not.

Very little work has been done on the economic and social aspects of fishing vessel crewing in the Pacific. McCoy and Gillett (1997) noted that information on employment can be sensitive in nature, and employers may be suspicious of the motives for such a study and can be hesitant to discuss details or supply information. Crew, particularly those in the U.S., may be hesitant to divulge income for tax or other reasons. False information may be provided by vessel owners in some countries with the intention of thwarting criticism of an industry that is known for harsh and dangerous working conditions.

From a fisheries management standpoint, crewing issues are ignored for the most part or thought of as a line item in assessments of financial performance. However, crews' direct involvement in shark finning and the fact that they are recipients of the bulk of revenue from shark fin sales are important to keep in mind. In evaluating the possible impacts of potential management measures this may helpful in assessing how the economics of vessel operation might be affected, even if only in an indirect manner. It may also be useful in helping to gauge the potential volume of shark finning that may occur if the crewing circumstances are altered from those existing at present.

Although a detailed assessment of the importance of shark finning to fishing vessel crews must await a much greater data collection and analysis effort than was possible during the course of this project, the following sections highlight some important aspects of this subject.

7.1 Crew Salary and Revenue From Shark Fins

Crew remuneration is one of the few expenses over which vessel owners can exert a fairly high degree of influence. There is a trade-off most often applied to the employment of deck crew in securing the best crew available at the least overall cost. In many fleets, the existence of potential income for crew from shark fins provides the vessel owner with an additional element with which to calculate the overall compensation for his crew.

The method of calculating payment for crews aboard commercial fishing vessels in the western and central Pacific can be divided into two types: those that are calculated on the basis of catch, and those on a "flat salary" basis. The U.S. longliners based in Hawaii and the U.S. purse seiners that deliver to American Samoa generally follow the first method; Asian longliners pay crew according to rates calculated by the second method. Crew members onboard Asian longliners are not necessarily the recipients of all their annual salary: a portion may be collected by employment agents or others in their home country.

On most Asian longliners finning is an integral part of fishing operations targeting tuna. Asian longline fleets obtain the bulk of their crews, sometimes unskilled and inexperienced, from countries other than the country of origin of the vessels, while retaining their own nationals only as officers. The countries supplying most of the crew are those that can supply labor at relatively low wages: Indonesia, Philippines, and China, as well as some Pacific island countries with very

limited employment opportunities such as Vanuatu and Kiribati. The crew are hired on a monthly salary of from $250 to $300 depending on nationality of the fleet and individual company wage policy within that fleet. Prospective crew may or may not have certain expectations or received guarantees regarding the additional money that can be earned from shark fin sales as a part of overall compensation.

7.2 Hawaii Longline

The longline situation in Hawaii is somewhat more complicated than that of other fleets described below. Vessels target either swordfish, tuna or a combination of the two. Those that target swordfish are sometimes reported to have operational constraints against taking and finning all sharks caught, by virtue of the small crew onboard and the occasional high number of sharks encountered. Fishermen are generally paid a share of the net proceeds from the catch, depending on their experience and level of skill among other factors, and the methods of calculating the shares can vary among vessels.

Little has been published regarding the compensation to crew on Hawaii longline vessels in recent years. However, it can be assumed that overall the shares earned by crew on an annual basis are substantially higher than the wages paid Asian crew on high-seas longliners as discussed above. Using information gathered in 1993 from 95 vessels active at the time, Hamilton (1996) calculated that average annual wages for a crew member (not captain) in the Hawaii longline fleet was about $22,000. Many changes have taken place in the fleet since that time, and it is not known how relevant such a figure might be in today's situation. For illustrative purposes, that figure is used and a factor[77] applied that raises the salary to a level of $25,000.

The overall estimated annual value of shark fins produced by Hawaii longliners in 1998 is estimated to be from $950,000 to $1,140,000. With roughly 400 deck crew in the fleet, and assuming that all shark fin revenue would go to the crew, the average annual income from shark fin sales would range from $2,375 to $2,850 per crew member or about 10% to 11% of the estimated annual wage. This figure may be slightly less, depending on the number of owner-operators who also share in the proceeds from shark fins.

Owners may have an incentive to encourage finning as a salary supplement to crew members in order to contain crew costs. However, as was stated earlier there were several owners who did not like the practice occurring on their vessels, and who evidently are comfortable with the level of crew compensation now paid and are not necessarily concerned about the effect the loss of fin income might have on their crew. On the other hand, several other owners felt that income from shark fin sales was an essential part of their crews' income, particularly when fishing was slow or market prices for the target species depressed.

The attitudes of crew members themselves are less clear. Even though prices have gone down considerably over the last 2 years, the number of finned sharks reported by the fleet has increased. It may be that crew who are newly immigrating to the U.S. or with certain ethnic backgrounds are more predisposed to finning despite the relatively small return. It may also be that they have become accustomed to the additional money and the reduced value has only encouraged them to fin more to maintain that level of income. All of these points, including the

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[77] The factor used is the Honolulu Consumer Price Index, which increased about 16 points from 1993 to 1997.

actual incomes earned in the fleet and the economics of the fishery in general, are subjects that need to be looked at in much greater depth than was possible during this project.

7.3 Korean High Seas ULT Longline

Although little is known of the financial aspects of the Korean ULT fleet's operations, they are thought to obtain crew in much the same way as do the Taiwanese and pay them roughly the same wages and in the same manner. While it is generally thought within the industry that Korean captains take a percentage of the shark fin money before passing on the remainder to the crew, it can be expected that incentives to collect and sell fins from shark bycatch still exist within the crew. Those incentives would be the low level of wages paid to crew and the expectation of immediate payment when fins are marketed through Hawaii, rather than waiting up to a year or more until the end of a voyage.

The nationality of crews on Korean longliners is somewhat different than that of other Asian fleets engaged in the high-seas ULT fishery. Unlike the Japanese, who employ almost exclusively Indonesian crew, or the Taiwanese who employ mainly mainland Chinese, there appears to be a preference for a crew of several nationalities on Korean vessels. As long periods at sea can exacerbate tensions between those onboard, this may possibly be to prevent crew solidarity in any confrontational situation with vessel officers. Crew is obtained from China (the majority), Philippines, Vietnam, Indonesia, Solomon Islands, Vanuatu, Fiji, and to a lesser extent Kiribati and perhaps Tuvalu. It is believed that the Chinese crew on Korean vessels come from "Korean China" (presumably an area of China near the Korean border) where the language, culture, and food are similar to that of Korea (Gillett and McCoy, 1997) .

Working conditions onboard all Korean longline vessels are difficult. In addition to the long trips there are the usual extreme working conditions found aboard vessels of this type: long hours on deck, lack of sleep for the crew, and sometimes poor food towards the end of a trip as supplies are used up.

Compensation for crew apparently varies by nationality, and probably by company as well. Wages for deck crew are calculated on a monthly basis, sometimes with a bonus added. Gillett and McCoy (1997) provided an overview of the terms and conditions of employment by citing employment contracts used for crew from two Pacific Island nationalities. In one case covering fishermen from Kiribati, a "fish bonus" of US$2 per t was specified with no mention of any other income source. In the other, applicable to fishermen hired through a Korean commercial company in Fiji, there was no tonnage bonus; however, a bonus was expected to be paid from shark fin sales. The major features of the one-year contract for Fijians,[78] including some perhaps intentional ambiguities, can provide some insight into the work conditions and compensation.

- Wages are $260 per month.
- 50% of the wages are to be paid to a specified party, 50% are retained by the employer until fulfillment of contract. If the contract is "prematurely frustrated" by

[78] Apparently, domestic law in Fiji precludes contracts onboard foreign fishing vessels lasting longer than one year because of the requirement to have the employee's family accompany him in the case of contracts longer than one year.

the employee, the employer shall have the right to recover expenses including repatriation from the 50%.

- Shore allowance of US$40 shall be paid to each crew member at the completion of each trip. In the case of the sale of shark fin, there is no shore allowance and the proceeds from the shark fin sale shall be shared equally among the crew.
- Crew shall work on Saturday, Sundays, and holidays during the fishing operation and a work day can "be up to 16 to 20 hours per day."
- A pack of cigarettes per day is to be provided during the term of embarkation.

If the estimated $2.37 to $2.64 million ex-vessel value of fins purchased in 1998 represents the total income to the fleet from shark fins, the annual per vessel income in a fleet of 150 vessels ULT longliners would be in the range of $15,000 to $18,000. As noted above, there are indications from some agents and others that captains on Korean ULT longliners retain 50% or more of the shark fin proceeds, leaving a crew of 22 to average from $340 to $409 per year in shark fin "bonus," or roughly the equivalent of 1.5 months' wages. This would correspond to information from interviews with Fijian former crew from one Korean ULT longliner in 1997 where at the time it was found that in addition to basic wages, they received about $300 each from shark fin sales after a 10-month voyage (Gillett and McCoy, 1997).

7.4 Japanese Longline in Guam

Japanese longliners based in Guam employ Filipino and some Indonesian crew on basically the same salary terms as those employed by the Taiwanese. Unlike the Taiwanese vessels operating from Guam, the crew of Japanese longliners participate in the revenue from shark fin sales made at the end of each trip. Several vessel agents noted that this income is important to the crew, as the bulk of their salary is sent directly back to their country of origin with only a portion provided for basic necessities. Thus, even though no shark carcasses are retained aboard the Japanese vessels, there is ample incentive for the crew to fin as many sharks as possible during fishing operations.

In January 1999 the 50 to 60 vessels actively fishing from Guam employed from 350 to 420 crew. On the basis of a shark fin ex-vessel value of $180,000 to $364,000, each crew member could be expected to receive from $409 to $827 per year. At the higher value, this would represent over two months' wages.

7.5 Taiwan ULT/albacore Longline

While wage payment levels may vary among owners and particularly among the different size classes of vessels in the Taiwanese fleet, several vessel owners interviewed in American Samoa and Kaohsiung indicated that the average base pay for Chinese crew hired pursuant to a three year contract on newer ULT vessels is $300 per month. This is the amount sent back to the recruiting agent in China to be paid to the crew member's family, with a percentage retained by the agent. A small living allowance of $50 per month is also reportedly paid the crew. Indications are that slightly lower wages are paid Pacific Islanders and Indonesians who work on the smaller albacore vessels. Since crew such as Pacific Islanders and Indonesians who are recruited from countries other than Taiwan appear to be paid their

repatriated wages in the currency of their homeland, the relative strength of the US dollar may insulate Taiwanese vessel owners from rises in crew wages over time.

Shark fin income is important because it has a large effect on the total wage package for crew on most vessels. According to one Taiwanese boat owner, in recent years when fin prices were high, it was possible for a crew member to double his wages if shark catches were good and the vessel had the opportunity to land the shark fin in a port where high prices are paid, such as Singapore.

The relatively low wages paid crew and the ability of vessels to market shark fins in ports where they periodically off-load are probably the two greatest factors encouraging the finning of sharks onboard Taiwanese longliners. Generally, there is adequate crew onboard to handle the sharks and attend to cleaning and storage of fins. Two captains interviewed, as well as those knowledgeable about the practice, stated that with the exception of thresher sharks (whose fins are considered of low value) all or nearly all sharks that can be brought onboard are finned.

Total annual crew costs incurred by owners of the Taiwanese longline vessels such as those delivering to American Samoa is from 26%–28% of total variable and fixed costs as shown in Table 17. Officers are much better compensated than ordinary crew, and with only three to four Taiwanese officers onboard, wages paid the bulk of the crew make up a relatively small percentage of operating costs as shown in the last row of the table.

Table 17. Estimates of annual wages of non-officer crew as a percentage of operating costs for Taiwan longline vessels

Target market (vessel class)	Cannery (small)	Cannery (large)	Cannery/ULT (small)	Cannery/ULT (large)
Total annual income	$777,000	$850,000	$1,392,000	$1,771,000
Total variable and fixed costs including wages	$733,000	$809,000	$858,000	$1,132,000
Total wages (including manning agency fees)	$199,000	$214,000	$239,000	$314,000
Total wages as % of total costs	27%	26%	28%	28%
Total crew number	18-20	18-20	18-20	25-30
Number of crew (exclusive of officers)	15-17	15-17	15-17	22-26
Wages of non-officer crew	$54,000-$61,200	$54,000-$61,200	$54,000-$61,200	$79,200-$93,600
Wages of non-officer crew as % of total costs	7.3-8.3%	6.6-7.6%	6.3-7.1%	7.0-8.3%

Source. Taiwan Deepsea Tuna Boatowners and Exporters Association, cited in Lightfoot (1998) and interviews in the industry

Officers as a rule do not participate in the distribution of revenue from shark fin sales; it is considered a crew "bonus." With the recent drop in shark fin value, several vessel owners and vessel managers interviewed in American Samoa said that if the shark fin bonus does not reach $300 per trip per crew member (for the large cannery/ULT vessels), they pay the bonus themselves to that level to maintain crew harmony. It is not known if this is a universal practice

among companies participating in the fishery. However, the relatively poor financial performance of the smaller classes of vessels as shown in Table 17 and reflected in the poor condition of many that call at American Samoa, would lead one to conclude that it is doubtful any funds would be spent on crew bonus in the event of low shark fin prices.

The overall estimated annual value of shark fins produced by the Taiwanese longliners that deliver to American Samoa (and not just that portion thought to be landed there) is estimated to be from $650,000 to $975,000. With roughly 1,400 non-officer crew in the fleet, the average annual income from shark fin sales would range from $464 to $696 per crew member.

In spite of the relatively small percentage of costs that wages to non-officer crew represent in the overall economics of operating these vessels, owners are not inclined to pay more. Their attitude towards crew wages seems to be greatly influenced by the almost limitless supply of inexpensive labor represented by such places as Indonesia or parts of mainland China. Having been hired under such conditions, the crews' low salary would tend to encourage them to fin as many sharks as possible.

On other Taiwanese vessels where crew do not expect to participate in fin revenue (such as Indonesian or Chinese crew aboard Taiwanese longliners based in Guam) the practice of retaining and caring for shark fins is probably considered just two of many tasks onboard that must be carried out in order to earn one's wages. Although no personal gain may be expected by the crew, the presence of Taiwanese officers who do expect to gain directly from the sale of the fins would tend to encourage the practice of finning on these vessels as well.

7.6 U.S. Purse Seine Vessels in American Samoa

Crew on purse seine vessels are paid on the basis of their experience, skill level and job assignment on the vessel. Crew from the Philippines or the Pacific islands on most vessels tend to get paid less than their US or European counterparts, as well as being recruited for positions requiring less skill onboard. Wages are calculated on a per ton basis, with a set amount per-ton paid to each crew at the conclusion of each fishing trip. Information from people involved in the industry indicates that it is the crew paid at lower wages, particularly the Filipino crew, that are most involved in shark finning.

Since the company owning the vessel does not completely settle with the cannery until all fish are cooked and final results of the volume of rejected fish is known, crew do not always receive their full salary upon completion of the trip and sometimes must wait up to several months for their final settlement. It is usual practice to provide an advance against the final wage settlement for most crew. Income from shark fin sales can be attractive because of these delays as well as the fact that vessel owners or agents who recruit Philippine crew on employment contracts are required to remit a considerable portion of the crew's salary directly back to the Philippines. This amount is used to pay the agent's commission and fees as well as distribution to the crew member's family.[79]

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[79] Because of the large number of Filipino seamen and fishermen employed worldwide, remittances of this sort are required by the Philippine government and provide a significant amount of foreign exchange for the country.

Apparently no census has been taken that might determine the pay level of Pacific islanders aboard purse seiners. With few exceptions they are known to be among the lower paid components of vessel crews. According to two FFA observers familiar with Pacific island crews, they are also generally keen to obtain additional money by shark finning and do not hesitate to participate in the activity aboard the seiners.

Table 18 gives an example of crew nationality and compensation from an example of a 1,200-ton US seiner. Total crew costs in 1997 for an 18-man crew on a typical US vessel fishing with experienced crew were $180 per t ($163 per short ton). Variations exist, particularly for salary or bonus for the fishing master and helicopter pilot or mechanic. Additional manpower can be added by hiring inexperienced deck crew at relatively low cost ($1.50/ton). Using a catch figure of 5000 short tons per year for vessels engaged in the fishery during a full year period, estimates of crew wages are shown in the last column of the table.[80]

Table 18. Crew costs for a typical U.S. seiner off-loading in American Samoa

Position	Nationality	Rate (per short ton)	Estimated annual wage
Captain/Fishing Master	USA/European	$40	$200,000
Navigator	USA	17	85,000
Chief Engineer	USA	30	150,000
Asst. Engineer	Philippines	12.50	62,500
Deck Boss	USA/S. American	14	70,000
Cook	European/S. American/USA	8	40,000
Seaman	South American/USA	10	50,000
Seaman	S. American	6	30,000
Seaman	S. American	6	30,000
Seaman	Pacific Islander	3	15,000
Seaman	Pacific Islander/Philippines	3	15,000
Seaman	Pacific Islander	2.50	12,500
Oiler	Philippines	2	10,000
Oiler	Philippines	2	10,000
Oiler	Philippines	2	10,000
Oiler	Pacific Islander/Philippines	2	10,000
Oiler	Philippines	1.50	7,500
Oiler	Pacific Islander/Philippines	1.50	7,500
	TOTAL per short ton	**$163.00**	

Source: McCoy and Gillett (1998)

[80] The estimated annual wages would be most accurate for the lower paid positions on the vessel, as they would be the least likely to have any additional incentive bonuses such as those sometimes provided to captains or other officers.

From the collection of anecdotal evidence through interviews with those familiar with the shark fin business in American Samoa, it appears that the volume of shark fins produced by purse seiners has decreased somewhat in response to recent lower prices paid for fins. This may be explained by somewhat lower incentive to the crew to fin sharks. Some in the industry believe it is because the reduced prices either cause the higher paid crew to either leave shark fin income to the lower paid crew members, or do not feel the time spent is worth the potential income. In either case, their decision not to participate in finning activities results in less manpower available from the non-Filipino and Pacific islander segments of the crew to fin the number of sharks caught during the purse seine process.

Assuming that eight crew per vessel participate in shark finning, the total number of crew involved would be 280 for an estimated 35 vessels that fished full time in the fishery during 1998. With total shark fin revenue in 1998 estimated to be from $162,000 to $230,000, the average share for those participating would be in the range of $578 to $821.

Table 19 shows the nationalities of crew members from three past surveys conducted by FFA.[81] As can be seen, both Filipino and Pacific islander components of crews have increased during the past three years. Since these two groups are those most involved with finning, the current level of finning described for U.S. purse seiners could be expected to remain constant or increase slightly if the financial incentives of crew salary and shark fin price remain about the same as at the end of 1998.

Table 19
Nationality of crew on U.S. purse seiners

Nationality of Crew	1994/95 (% of total crew)	1996/97 (% of total crew)	1997/98 (% of total crew)
United States	26.5	27.6	24.7
Philippines	19.7	24.9	25.7
Portugal	12.2	11.1	9.0
Croatia/Yugoslavia	11.6	6.4	5.1
Latin America	8.9	5.7	11.1
Pacific Island	8.5	14.8	17.6
Others/unknown	12.6	9.5	2.2

Source: FFA

7.7 Summary

On the basis of the above discussion, Table 20 provides a summary of estimates of annual average crew salary and amount received from shark fin sales. Annual wage figures are for those deck crew that would be expected to be engaged in finning of sharks and sharing of proceeds. Korean ULT shark fin sale income is calculated on the basis of 50% being returned to the crew. For all other fleets it is expected that crew would share in 100% of the proceeds.

[81] The 1994 to 1995 period covered 35 of the 38 vessels, while the 1996 to 1997 period covered 31 of 34 vessels. The number of vessels covered by the 1997/98 survey is unknown.

Table 20. Estimated individual average annual crew salary and annual individual amount received from shark fin sales, 1998

Fleet	Annual wages	Shark fin sale income	Total compensation	Shark fin income as % of total
Hawaii longline vessels	$25,000	$2,300 - $2,800	$27,300 - $27,800	8%-10%
Korean ULT vessels	$3,000	$340 - $432	$3,400 - $3,432	10% - 13%
Japan longline in Guam	$3,600	$409- $827	$4,009 - $4,427	9% - 21%
Taiwan ULT/albacore vessels	$3,600	$464 - $696	$4,064 - $4,296	11% -17%
U.S. purse seine	$7,500 - $15,000	$578 - $821	$8,078 - $15,821	4% - 10%

While the contribution of shark fin revenue to the individual average annual crew compensation may appear relatively small, from another perspective it could be significant in terms of aggregate crew compensation and resulting morale. For example, based on the figures above in Hawaii's longline fishery the annual compensation to a crew of four could be around $10,000. On some vessels where foreign or immigrant crew members are related and share living expenses or other costs in Hawaii, this aggregate amount might be more important than the individual per-crew amount would indicate.

From the sparse amount of information available, it is difficult to definitively determine the impact of shark fin price on the decision to retain shark fins in each of the fleets discussed. However, given available information and what is known about the operations of the fleets generally, it appears that with the possible exception of U.S. purse seiners, shark fin price does not currently have any direct impact on the decision to fin sharks in any of the fleets. It can be reasonably expected that the practice of finning would continue onboard these vessels, regardless of the price received for the fins.

Hawaii may be a special situation, as several owner-operators with experience in the fishery going back to the 1980's indicated that at the prices the received at that time, around $5 or so per pound, there was little incentive to retain shark fins. Since that time, there has been an influx of vessels and an increase in the trend of employing immigrant crews. In light of changing demographics in crew, it is not certain that prices as low as those experienced 10 or more years ago would discourage finning activities.

It should be reemphasized that the capture of sharks by all these vessels is incidental to fishing operations targeting tuna (or swordfish in the case of a portion of the Hawaii longline fleet) and crews have no influence over factors that might contribute to the capture of more or fewer sharks during the course of normal operations.

8. THE DIRECT ECONOMIC CONTRIBUTION OF SHARKS TO THE ECONOMIES OF HAWAII, GUAM, AND AMERICAN SAMOA

It is considered impractical here to view the overall economic impact of sharks alone to the economies of Hawaii, Guam, and American Samoa since the capture of sharks, while caught incidentally to the target species by each fleet concerned, are an integral part of the activities of those fleets. For some of these fleets, practically no information is available, while others have been studied in varying degrees but none recently. Important elements of Hawaii's longline fishery in 1993 have been reported by Hamilton et al. (1996), but the information needs to be updated for such operational items as vessel capacity and overall fleet size, and expanded to cover operational configurations, crew composition and compensation. Hamnett and Pintz (1996) surveyed the importance of tuna fishing and transshipment economies to Guam and American Samoa for 1994 and 1995, but the impact of landed bycatch was not addressed. Information contained in other attempts at quantifying the impact of commercial tuna fishing activities in Guam (Anon., 1996) and American Samoa (Zodiacal, 1994) are incomplete or already outdated owing to changes in operational factors referenced in those studies.

Therefore, this section attempts to quantify the direct economic contribution of the sale of shark and shark fins in each of the three geographic areas by assessing the ex-vessel value of these products and, in the case of shark fins, the added value brought about by the trading function in terms of the traders' gross margin. This latter element is difficult to quantify given the fluid nature of the business and the general downward movement in the value of the commodity as exemplified by the trend shown in Figure 9. For these reasons, gross margins assigned to each location are somewhat arbitrary, but are based on the following factors:

- Expense costs are assumed to be highest in Hawaii and lowest in American Samoa.
- Higher net profit is assumed for Hawaii because of the relatively low level of competition on the mainland brought about by factors described in Section 5.
- The potential for unbridled profits for all locations is tempered by the various levels of trading that exist between ex-vessel purchase and final use and the internationally traded nature of the commodity.

8.1 Hawaii

8.1.1 Domestic Longline Landings

The ex-vessel payments for shark fins, estimated in 1998 as $950,000 to $1,140,000, are paid directly to crew. While some vessel owners characterize the income as "beer money," there is really no way to determine how or where the recipients dispose of this income. It is recognized that some crew members from the U.S. mainland or elsewhere may send money out of the state; however, there is no information available that might indicate the amounts, if any. Crew shares

from both the sale of the catch and shark fins are paid directly to the crew and are thus assumed to be spent or retained in the state[82].

The shark fins produced by the locally based longline fleet in 1998 are estimated to be about 29% by volume and from 36%-48% by value of those produced by high-seas ULT vessels brought to Hawaii for transshipment. Leaving aside the possible ramifications brought about by participation of tankers in the high-seas trade described below, the following differences would seem to favor assigning an increased impact in the state from the fins produced by the local fleet over those from the high-seas ULT vessels:

- Money paid for the fins goes directly to crew members and in a few instances to owners who are resident in the state.
- The organization of the shark fin trade would indicate that for a significant portion of the fins there are at least two tiers of buyers involved, including the primary buyers and their agents.
- There are at least two active buyers who are residents of Hawaii, have business offices and conduct business activities in Hawaii on a daily basis.[83]
- Some primary processing that adds value to the product may take place in the state prior to shipment overseas.

8.1.2 Shark Fin Traders

It is not known if shark fin traders in Hawaii purchase fins and speculate in the market or if they have particular trading arrangements with established buyers or end-users. Shark fin production discussed here covers only that produced by locally based longline vessels. It does not include the importation and processing activity reported by one trader who says he imports unstated amounts of frozen shark fins from Spain on a monthly basis and employs five people in drying and processing the product for export to Hong Kong (Wong, 1999).

The Hawaii-based shark fin traders are assumed to be purchasing on their own account and operating on a gross profit margin of 35%. Within this margin are direct expenditures for handling and carrying expenses, shrinkage and spoilage loss, shipping, payments to purchasing agents, any primary processing that might be undertaken, and the traders' profits. This increase in the value of the product means that when fins leave the state, their value has increased $332,000-$399,000 for a total product value of $1,282,000 to $1,539,000. Although technically not entering international commerce, comparing this amount to total export sales for the

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[82] Although there has been no research into the possible level of remittances by FSM fishermen living in Hawaii, one study in 1994 indicated around 3% of the total estimated income earned by FSM migrants on Guam and the Northern Marianas was remitted back to FSM (Hezel and Levin, 1996). Since there is no organized remittance scheme for the crew members from FSM such as those for crew hired through manning agencies for other nationality fleets in the western and central Pacific, and because the cost of living is higher in Hawaii than Guam, it is assumed that Micronesians either spend or retain their income in the state.

[83] As with every location covered in this study, shark fin buyers in Hawaii are engaged in other businesses as well as the shark fin trade.

Honolulu metropolitan area during the last five years of $232 million would show shark fins to be about 0.6-0.7% of exports.[84]

8.1.3 Shark Sales

A much smaller amount, estimated to be $42,000, is realized by longline vessel owners from the sale of shark at the Honolulu fish auction. Overall this is a miniscule amount, about 0.07%, of the estimated revenue of Hawaii's commercial longline fleet, estimated to have been over $59 million in 1997 (Anon., 1998). With approximately 100 active vessels in the fleet, the average income derived from the sale of sharks would be about $400 per vessel per annum. It is not known how many different vessels sold shark meat during the year; if sales came from just a few vessels, then the impact would of course be greater for those vessels.

A small trade exists for the gall bladders of sharks taken from some of the catch for use in the preparation of a particular medication unique to east Asia. Crew on some vessels dry and retain the gall bladders until there is an unspecified amount large enough to draw interest from the buyer or buyers. The extent of this trade and the value it represents is unknown but is thought to be small. Recently one shark fin buyer in Honolulu has expressed an interest in obtaining the properly prepared skins of blue shark. It is not known the extent to which skins are collected, but this is also thought to be a small amount.

8.1.4 Direct Government Revenue

The transactions involving the purchase of shark fins are always for cash, paid at the time the fins are sold to traders or their agents. It is assumed that the sellers, i.e. the crew not the owner of the vessel, do not possess Hawaii State General Excise Tax licenses and do not report these transactions. Applying the general excise tax rate for wholesaling of 0.005, the total lost government revenue from such transactions would amount to $4,700 to $5,700 in 1998. With over 1,100 trips taken annually by Hawaii longline vessels, the lost revenue to the state from such transactions can be estimated at from $4.27 to $5.18 per trip.[85]

8.1.5 High Seas ULT Longline Transshipment

Because the transshipment of shark fins in Hawaii from high seas ULT longline vessels involves re-export of the fins and no processing or sale within the state, the major direct economic contribution to Hawaii would appear to be restricted to those direct expenditures connected with transporting the fins to Honolulu and onward shipping to Asia.

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[84] It could be argued that every little bit helps. According to the International Trade Administration of the U.S. Department of Commerce, Honolulu ranks 170th in the nation in export sales, just above Brockton, Massachusetts and Terre Haute, Indiana.

[85] Potential government income tax revenue that may be lost from unreported income is more difficult to assess because it is not known how much of the crew income from shark fin sales is reported to tax authorities. Even assuming that some or all shark fin income is not reported, potentially different and varied income tax situations for crew members within the fleet make such a computation impossible.

However, if the ability to transship fins through Hawaii is a major attractant to tankers calling to obtain fuel and supplies or servicing the fleet and who subsequently provide the platform for shark fin purchases and transfer to Hawaii, then consideration should be given to the catalytic effect of the shark fin trade.

Direct expenditures for transportation and shipping for 1998 are estimated on the basis of 12 transshipments by locally based fishing vessels participating in the trade. These expenditures are estimated to be $235,000 consisting of vessel and crew hire of the transshipping vessel, agency and customs brokerage, user fees, storage, land transfer by bonded cartman, wharfage, and shipping costs to the final destination.

Since the shipment is stored in bond and no value is added in Hawaii, any further direct economic contribution would appear to be limited to income derived by the locally based trader. Because the business arrangements undertaken between the trader in Honolulu and the eventual recipients in Asia are not known, it is not possible to determine how much actual economic contribution for the state can be attributed to these shipments. Assuming a reasonable commission of 4%, the amount could be in the range of $95,000 to $105,000 based on the value of fins estimated at $2,376,000-$2,640,000.

As has been mentioned above, the collection of shark fins from fishing vessels on the high seas is carried out by tankers that are resupplying the fleet. Those tankers obtain fuel and supplies in Honolulu and return to the high seas to carry out their primary job: servicing the fishing vessels. The direct purchases of tankers servicing the fleet are considerably greater than that of the direct expenditures noted above. One shipping agent estimated that each port call was responsible for between $750,000 and $1,000,000 in purchases in the state (Cheu, 1999). If there were 12 tanker visits, the purchases would total from $9 million to $12 million.[86] If the transshipment of fins through Hawaii acts as a major attractant to the tankers that collect fins in this manner, then consideration should be given to including all or a portion of the revenue from such business in the consideration of economic contributions from sharks.

In terms of absolute necessity the greatest attraction of Hawaii is as a port to obtain fuel and supplies rather than the opportunity to trade in shark fins. The most probable factors influencing the decision to visit Hawaii are the fuel price or credit terms a refinery might offer, the availability of other supplies for the fishing vessels such as fresh vegetables and other foodstuffs, and the geographic placement of the bulk of the fleet that makes Hawaii a more favorable location than other ports.[87]

Although it is believed that the actual trade is carried on by the captain of the tanker on behalf of others and does not involve the ship owner, the supply of fuel to fishing vessels at sea is a highly competitive business. One tanker operator considered the involvement of his tanker in the shark fin trade as a necessary service that must be provided to attract the maximum number of customers.

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[86] Oil refinery sales to tankers that service high-seas fishing vessels are estimated by one refinery to have been $16 million in 1998 and $21 million in 1997 (R. Wong, pers. commun.).

[87] As floating refueling stations, the tankers try to place themselves in the best geographic position to serve the greatest number of vessels. It is the general practice of fishing vessels to move to the tanker, not vice versa.

The $9 million to $10 million figure above is thought to include fuel as well as food and miscellaneous supplies that are taken offshore and transferred to the fishing vessels. Fishermen onboard high-seas longliners must purchase some necessities and amenities while at sea such as cigarettes, snack food, toothpaste, and so forth. It is common for ships that stay at sea for long periods to operate a store onboard for this purpose, sometimes called a "slop chest" on commercial vessels in the west. It can be assumed that at least some of the cash produced by the trade in shark fins allows fishermen aboard the vessels to purchase items without subsequent deductions from their wages.

Other ports available to the tankers as options to Honolulu would appear limited. There are no other oil refineries in the central, western, or southern Pacific. The closest refinery locations at which tankers could obtain a cargo are in Panama, Melbourne, and Singapore. Bulk depots capable of supplying adequate quantities of fuel, but most likely not at refinery prices, exist in Guam, Marshall Islands, and Fiji. The range of supplies other than fuel would be much more limited at the two latter locations, while Guam prices are higher than Hawaii because of local storage costs and transportation costs from refineries in Singapore.

The conclusion here is that while Hawaii does currently play a key role for the transfer of shark fins from the ULT vessels on the high seas, the main attraction is the availability of refinery-priced fuel, the relative proximity of Hawaii to the fishing grounds when compared to other sources of fuel supply, and the availability of other needed supplies.

8.1.6 Options Other Than Hawaii for the Sale or Transshipment of Shark Fins from High-Seas ULT Longline Vessels

Logistically, only two other potential options appear to be available to the fishing vessels to off-load and sell shark fins:

- Selling to or through the ULT refrigerated fish carriers that are met periodically on the high seas or in port to off-load sashimi grade tuna back to Japan and Korea.
- Holding all fins onboard until return to port for final off-loading of the catch at the end of a high seas deployment.

The ULT refrigerated carriers operate on a regular cycle throughout the Pacific. There are six such companies, all owned and controlled from Japan. It is believed that some of these vessels are involved in the carriage of shark fins from Japanese ULT vessels fishing in the central and eastern tropical Pacific. Shark fin buyers exist in the three major Japanese longline ports handling the catch of these vessels: Shimizu, Yaizu, and Misaki. Logistically this appears to be a viable option; however, it is not possible to determine its practicality from a business perspective.[88]

The option of holding and storing all fins onboard until final return to port at the end of the ship's deployment would depend partially on the space available for storage onboard and also

[88] In an interview in March 1999 an official of Japan Tuna said that the organization's tankers never handle shark fins. Any fins not brought to port on the final voyage of a vessel's deployment might be transferred to the transport vessel collecting fish for delivery to Japan (Y. Harada, pers. commun.).

the disposition of Pacific island or other crew prior to the ship's return to Korea. If the vessel's capacity did allow for storage of all fins onboard, a practical problem may be created for Pacific island crew who are normally discharged in the region to their home country prior to the vessel's return to Korea. If they were not paid for shark fin because it had not yet been sold, there could well be adverse consequences for future recruiting when crew did not receive the anticipated compensation. Even those crew remaining onboard would have to wait a year or more before there could be any income realized from the sale of shark fins since the deployments of vessels in the fishery are at least that long. Perhaps a bigger obstacle would be that if shark fins were not sold until the end of the trip, neither group would have the cash that allows them to purchase necessities and amenities from the tankers or from their own vessel while at sea.

For the tankers, there appear to be two other possibilities to get fins already collected from fishing vessels to market:

- Off-loading at a designated land-based site in the central Pacific for later transshipment.
- Arranging a dedicated vessel that would pick up fins on the high seas and take them to another location in the central and western Pacific for transshipment.

For tankers to off-load at a relatively geographically advantageous land-based site would appear to be impractical. The onward shipping from all but the largest ports in the central and southern Pacific is erratic. Traders would not want to face the additional costs and potential delays of such an operation. Given the dispersed nature of fishing across a wide area of the central Pacific, it would be unlikely that the fishing vessels themselves would be in a position to regularly deliver fins to a central point.

Logistically, it might be possible for a dedicated vessel to pick up fins from the tanker in the same manner as now and deliver the fins to a larger port such as Suva or Apia for onward shipping. However, the costs involved could be significant, and the risk of operating a smaller vessel on the high seas would be greater than allowing tankers to carry the cargo close to Hawaii. It would be less practical for a dedicated collection vessel to visit each fishing vessel individually, as the inefficiencies created would increase the cost of fins and increase the trader's risk.

From a strictly logistics standpoint, the most practical option available would be to shift the shark fin buying operation to the high-seas ULT refrigerated vessels. However, their visits to the fishing vessels may not be as frequent as the supply tankers, and there could be added costs incurred when the fins are imported into Japan.

8.2 Guam

8.2.1 Japanese Longline Vessels

The direct contribution from sharks to the economy of Guam from Japanese longline vessels comes from Filipino and Indonesian crews who spend most of the annual total of $180,000 to $364,000 in proceeds from shark fin sales ashore during port calls. Employment

arrangements require most of a crew's wages to be remitted back to their home country directly, and as a result they have little money to spend for the purchase of necessities while living on the vessel. Several vessel agents remarked that it was important for crews to receive the money from the sale of shark fins, as the living allowance portion of their salary that was not repatriated, $40 to $50 per month, was insufficient for basic necessities.

8.2.2 Taiwanese Longline

The direct contribution from Taiwanese vessels delivering frozen shark fins and frozen shark for transshipment is mainly in the transfer and shipping of these commodities to Taiwan. As explained in Section 6 the volume of wet fins and frozen shark estimated to have been landed in Guam and exported to Taiwan in 1998 was from 14 to 18 t and 38 to 56 t, respectively. These shipments were included with other bycatch in standard freezer shipping containers. Assuming that each shipment listed in Table 12, Section 6, represents one standard 20 foot shipping container, and shipping and handling costs of $3,500 per container to the Asian destinations, the contribution would be on the order of $53,000.

8.2.3 Shark Fin Traders

Shark fins purchased in Guam are only those dried fins produced by the Japanese longline vessels. As in Hawaii, it is assumed that traders in Guam purchase on their own account rather than for others overseas. As such, a gross margin of 30% is estimated to represent handling and carrying expenses, payments to purchasing agents, shrinkage and loss, any primary processing that might be undertaken, and the traders' profits. This represents from $54,000 to $109,000 in additional contribution into the economy of Guam.

8.2.4 Direct government revenue

Guam has no export tax, so no direct government revenue would be realized from these outbound shipments, other than the usual port fees that are already captured in the category above.

8.2.5 The Importance of Guam as a Purchase and Transshipment Point and Options for the Sale of Shark Fins

There is some value to the Japanese fishing vessels in being able to sell shark fins on Guam, as crew income and morale are bolstered. There is probably greater value to the Taiwanese to be able to transship frozen shark fins and sharks from Guam direct to Kaohsiung with other frozen bycatch. It would be logistically more difficult and more expensive to conduct the latter operations in alternative ports in Micronesia. However, it should not be assumed that all Taiwanese vessels require FSM as a fishing ground and Guam as a subsequent base for transshipping. The falling arrivals in Guam are indicative of a shift in fishing grounds by some vessels to other locations in the western Pacific, including specific transshipment locations of General Santos and Bali.

For those Taiwanese vessels that do remain and fish in FSM, transshipped cargo in freezer containers would be more expensive from FSM ports than Guam and with poorer and less frequent shipping connections that would in turn require longer storage time and increased expense. For dried shark fin from the Japanese vessels, it would be easier to switch the ex-vessel purchase point to FSM or Palau. While buyers of dried shark fin have been known to operate in those countries, smaller volumes are probably collected at any one site because of the dispersal of vessels to more than one port. The small fin volumes may hinder traders in obtaining leverage in the market to gain better prices, and consequently lower prices may be passed along to vessels in those ports. Timely shipment is also more of a problem in FSM than Guam and would result in higher carrying costs for traders.

The degree to which all of this would be a concern to Japanese vessel owners who allow crews to keep the proceeds from shark fin sales is not known but is probably small. The ability to sell dried shark fins in Guam or ports in FSM is not the determining factor in a decision to visit Guam for transshipment. Rather, factors such as airline schedules, air freight and other handling costs, availability of repair facilities, and fuel price are much more important. If the vessels did not visit Guam, or if there was no opportunity to sell shark fins on Guam, fins could be held onboard until arrival at an FSM port where they could be sold, although at perhaps lower a return to the crew than on Guam.

8.3 American Samoa

Approximately 80% of the shark fins sold in American Samoa are landed by distant-water longliners, with the remainder coming from U.S. purse seiners.

8.3.1 Taiwanese Longline Vessels

While it is known that the crews of Taiwanese longline vessels receive the proceeds from the sale of shark fins as a bonus, it is difficult to assess the amount of money that remains in American Samoa. Although no fleet-wide census is available, several owners and officials of the Taiwan Deepsea Tuna Boatowners and Exporters Association claim that a vast majority of non-officer crew employed aboard Taiwanese longliners, up to 80%, are from mainland China. Spending habits of these and other crew aboard the longliners are not documented. Spending habits of the remainder of the crew, comprised of Pacific islanders and some Indonesians and Filipinos, may be different from those of mainland Chinese. With the Chinese crew, it is probable that spending practices would result in less of a percentage of the revenue from shark fins being spent in American Samoa than by crews in Hawaii or Guam. There are several reasons for this. Unlike the vessels in Hawaii and Guam that take relatively short trips, usually less than a month long, crews from Taiwanese longliners visit American Samoa only once or twice per year, and the opportunities to spend are fewer. Taiwanese agents in American Samoa were of the opinion that crew from mainland China were frugal with their bonus money, purchasing only necessary personal items in American Samoa because they desire to retain as much income as possible during their 3-year work contract. Unlike most other ports, American Samoa does not allow vessels to purchase duty free "sea stores" to be taken offshore. This discourages some spending ashore, as cigarettes and other items are taxed locally.

Even if longline crew spent only a half of their bonus money in American Samoa, the large number employed in this fleet, estimated to be around 1,100 fishermen, would still mean a considerable amount of spending ashore. For purposes of estimating the contribution to American Samoa, it is assumed that 50% of the total shark fin bonus money, or from $260,000 to $390,000, is spent in American Samoa by the crews of Taiwanese longliners. This may not represent all spending, as two vessel owners indicated that they also provide $50 per month for incidentals for vessel crews as a condition of their employment contracts.

8.3.2 U.S. Purse Seiners

In contrast to the crews aboard Taiwanese vessels, crews aboard U.S. purse seiners spend large amounts of money ashore in American Samoa. However, the degree to which the lowest paid crew on these vessels, those most likely to be the recipients of shark fin revenue, participate in such expenditures is not known.

Some assumptions can be made on the basis of overall crew compensation and the need to purchase necessities ashore. Zodiacal (1994) estimates that individual crew members on purse seiners are advanced up to $1,000 per port call for "entertainment, accessories, personal equipment, etc." While this may hold true for the crew with higher levels of compensation, it is doubtful that those at the lowest levels are provided with such advances. If vessels call 5 times per year, such an advance could represent up to two-thirds of annual salary. As noted earlier, for many of the Filipinos, the bulk of their salary is remitted directly back to the Philippines, so large amounts of money are not available to them for spending sprees in port. Shark fin money thus could play an important role in providing these crew with the ability to purchase needed supplies ashore as well as some of the items cited by Zodiacal. It is realistic to assume that most or all of the $162,000 to $230,000 received by the crews from shark fins sales is spent in American Samoa.

8.3.3 Shark fin traders

Two of the shark fin buyers contacted in American Samoa indicated that they purchased fins on their own account. Both said that the business was not nearly as lucrative as it had been in the past and that the drop in prices during 1997-1998 as well as the reduced number of longliners calling at American Samoa, was the main reason. Both traders have extensive business interests outside of shark fin trading, and utilize employees from those enterprises in the handling and storage of shark fins purchased from fishing vessels. One indicated that he had a small drying and packaging plant where fins were further dried with mechanical hot air dryers and trimmed before shipment. As with traders in other locations, those in American Samoa must account for handling and carrying expenses, shipping, payments to purchasing agents, shrinkage and loss, as well as the primary processing mentioned. Because the cost of doing business in American Samoa is less than that in either Guam or Hawaii, a figure of 25% is used to account for all these costs, plus the trader's profit. The total contribution to the economy is thus calculated at $123,000 to $187,000.

8.3.4 Direct Government Revenue

Income to the American Samoa government from the 5% tax on the sale of shark fins has not produced much income. Reasons for this have been mainly the difficulty for Customs officers to monitor the actual sales which they say often are clandestine and occur at night or at locations away from the vessels. Since June, 1997, collections have totaled $6,519 out of a theoretical $34,100 to $50,000 based on estimated fin value.

8.4 Summary

Table 21 summarizes the total direct economic contribution information from the preceding paragraphs. The total ex-vessel value of shark fins produced in or transshipped through Hawaii, Guam and American Samoa in 1998 was from $4,223,000 to $5,259,000. Mainly because of the large volume and correspondingly large value of fins from ULT longliners that are transshipped and never enter commerce in Hawaii, the total value of the direct economic contribution to the three economies is in the range of $2,398,000 to $3,189,000. Of this, Hawaii received roughly 61% of the total, Guam 14%, and American Samoa 25%.

Table 21. Summary of the direct economic contribution of sharks to the economies of Hawaii, Guam, and American Samoa ($'000)

	Hawaii	Guam	American Samoa	Total
Crew spending from shark fin revenue	$950 - $1,140	$180 - $364	$422 - $653	$1,552 - $2,157
Fresh shark meat sales	$42	-0-	-0-	$42
Local transshipment expenses	$235	$53	-0-	288
Trader gross margin	$332 - $399	$54 - $109	$123 - $187	$509 - $695
Direct government revenue	-0-	-0-	$7	$7
TOTAL	**$1,559- $1,816**	**$287 - $526**	**$552 - $847**	**$2,398 - $3,189**

9. SHARKS IN THE CULTURAL CONTEXT

Although not the main focus of this study, familiarity with the cultural attitudes in Hawaii, Guam, the Northern Mariana Islands, and American Samoa towards sharks may be helpful when discussing possible management regimes with the public at large. While the resources provided for this study did not allow investigating this subject in any great detail, a review of some of the information in the literature provides a familiarity with the topic for Hawaii and American Samoa.

Unfortunately, a cursory search has found that little has been written specifically on cultural attitudes towards sharks in Guam and the Northern Mariana Islands. Interviews with several local fishermen and boat operators in both locations found what could be considered pragmatic attitudes: sharks are apparently considered a serious nuisance and a threat to their livelihood. There did not appear to be any reservation toward lowering the shark population through intense fishing activities based on cultural considerations in either location.[89] The Guam Fishermen's Cooperative had put forward a proposal to utilize a confiscated Taiwanese longliner in a shark control project, and several fishermen in the Northern Mariana Islands said they would welcome a fishery directed at sharks that might reduce predation during their own bottomfishing operations. Given the very limited information from Guam and the Northern Mariana Islands, the following discussion will focus on Hawaii and American Samoa.

9.1 Hawaii

The most comprehensive compendium of published information on the subject of sharks and the Hawaiian culture can be found in Taylor (1993). Various publications of Mary Kawena Pukui also are cited by Taylor as a rich source of information connecting sharks with Hawaiian tradition, culture, and beliefs. Although the following is taken from these two sources, there may be other, unpublished sources such as those in oral histories or contemporary experts. Both authors are careful to describe what they believe are beliefs held in the past by placing the sentence in the past tense, as in "The Hawaiians believed..."[90] Sharks had a role as spiritual figures, as pointed out by Taylor:

> Some sharks were revered as influential spirits important to a geographic area like Pearl Harbor or Halawa Valley. Others were more limited in their influence and were special to particular families or individuals. The Hawaiians believed that under certain conditions, sometimes with the assistance of surviving family members, a deceased relative was reincarnated in the form of a shark - not any shark, but a specific shark known by a special name.
>
> Such a shark could be an *'aumakua*–a beneficent guardian spirit, a family protector, a fishing helper–or an *'unihipili*–a spirit that would do the bidding, for ill or for good, of its sorcerer-caretaker. Sometimes an *'aumakua* was brought

[89] It is possible that greater investigation would have found positive attitudes towards sharks based on other than cultural grounds, perhaps in the context of conservation. However, this was not pursued during the research due to time constraints.

[90] It is more difficult to determine current beliefs and the authors of this study do not purport to be able to represent what are currently held beliefs within the Hawaiian community.

> forth with the help of a *kahuna*; sometimes they appeared unbidden. There were also *'aumakua* in the form of other animals besides sharks. These included owls, mudhens, sea turtles, eels, caterpillars (and their marine counterparts, sea cucumbers, even rocks and plants).

Taylor points out that few people today can authoritatively say which species of sharks were *'aumakua*. He cites a U.S. National Park Service pamphlet from Pu'ukohola heiau that there were special shrines (*heiau*) constructed near the shoreline for the purpose of sacrifice to sharks which were thought to gather seasonally and suggests these might have been aggregations of gray reef sharks similar to those seen in more recent times in the northwestern Hawaiian Islands. The territoriality of certain reef sharks may also play a role in defining them as *'aumakua*, but such discussion is speculative.

In reviewing Hawaiian names and terms for sharks, Taylor mentions that while there are 34 species of shark recorded by modern biologists, there are nine kinds of sharks listed in Pukui and Elbert's *Hawaiian Dictionary*. He suggests that while some deep sea species might have been unknown, it is also possible that some names previously used are now lost. In statements perhaps most relevant to current day events, Taylor makes the argument that

> It is careless, inaccurate and perhaps even irresponsible for modern commentators to make such imprecise statements as "sharks are sacred to Hawaiians" and "Hawaiians did not kill sharks", or "sharks were important food for Hawaiians." Such statements are true for some species, but we are by no means certain which species match which Hawaiian names.

He goes on to speculate and make informed guesses about which sharks might be represented by names presently known, and emphasizes that, "...ancient Hawaiian culture was complex in its consideration of sharks and recognized that different kinds were to be treated in special ways unique to each species and, in some cases, unique to individual sharks."

The term mano is acknowledged as the generic name for sharks. Of those most easily identified by Taylor, it is perhaps not surprising that they are the inshore or reef species with which people would most likely to come in contact on a more regular basis than those offshore. The shark known as *lalakea* is matched up with *Triaenodon obesus*, the white tip reef shark. *Lele wa'a* is thought to be the whale shark, *Rhincodon typus*, and *mano pa'ele* might be the blacktip reef shark, *Carcharhinus melanopterus*. But there are apparently no Hawaiian names now known for relatively abundant species such as the gray reef shark, *Carcharhinus amblyrhynchos*, or the sandbar shark *Carcharhinus plumbeus*. The shark known as *niuhi* is thought to be either the tiger shark, *Galeocerdo cuvier*, or the great white shark, *Carcharodon carcharias*.

From the material culture of ancient Hawaiians, one can see that some species of sharks were used in a utilitarian fashion as well as serving more spiritual functions. As with many places in the Pacific islands drum heads, war clubs, and cutting tools were all made from or incorporated parts from various species of shark. Obviously sharks had to be captured and killed for these uses, and Taylor cites a passage written in 1870 by Kamakau that describes a fishing expedition for large *niuhi* that used the lasso technique known in other parts of the Pacific from New Guinea to Tokelau and Samoa.

As was stated above, it is not possible to explore this subject, particularly currently held attitudes, in any great depth. However, the recent introduction of proposed legislation in the Hawaii State Legislature relating to sharks allowed some to voice their opinions and beliefs in a public forum. For example, testimony from the Chair of the Kaho'olawe Island Reserve Commission stated in part that, "...the KIRC believes shark finning is a shameful act that painfully attacks our cultural and spiritual beliefs including sharks as *'aumakua*, or family guardians (Aluli, 1999)".

In supporting the legislation that would ban the practice of finning, a private citizen testified in part that, "The shark is my family *'aumakua*. Therefore, I support the passage of HB 1706 (Keanaaina, 1999)". Other written testimony submitted to the legislative committees from several private citizens mentioned the *'aumakua* status of sharks in Hawaii without further specific references. If nothing else, these written statements acknowledge that a portion of the general public recognizes there is a cultural or spiritual connection between at least some Hawaiians and sharks, even if that connection cannot be accurately or completely defined.

The conclusion that one might draw from this admittedly sparse information is that while specific species of sharks or specific sharks were or are considered *'aumakua* by an undefined segment of the population, this rather limited role has been transformed and expanded in more recent times into a form of "existence value" for most or all sharks by a much larger segment of the population than those directly involved in an *'aumakua* relationship.

9.2 American Samoa

Knowledge of sharks in Samoa is an interesting comparison to Hawaii, where it is assumed that many specific names for sharks have been lost. Wass (1984) assembled a committee of four older fishermen from both American and the former Western Samoa to identify various shark specimens as part of an overall project to collect and identify fish in the territory. Recognizing that the term *malie* referred to sharks in general in much the same way as *mano* did in Hawaiian, the committee identified 10 using 12 different names out of a total of 17 specimens representing different species. This compares with the nine names collected in Hawaii out of 34 species. There are no doubt more species in Samoa that were not collected and presented to the committee, particularly deep sea species.

Of particular interest is that two of those identified are pelagic sharks: the short fin mako, *Isurus oxyrinchus*, called *aso-polota*, and the oceanic white tip, *Carcharhinus longimanus*, called *apoapo*. Others known by Samoan names include the nurse shark and other inshore species such as the gray reef shark, black tip reef shark and the scalloped hammerhead, *Sphyrna lewini*. The tiger shark, known from both inshore and pelagic environments, is known as *naiufi* in Samoa.

Like Hawaiians, who apparently undertook offshore fishing expeditions for the express purpose of capturing large sharks for food (Kamakau, cited in Taylor, 1993), Samoans likewise sought to specifically capture large sharks during fishing expeditions (*lepaga*) for that purpose. Severance and Franco (1989), using both informants and prior published sources, describe such an expedition, called *tiu malie*

> Shark fishing was initiated by negotiations between *tautai* (master fishermen) and chief....A food presentation was made to assure the success of the shark expedition....The main instruments used in shark fishing were the nose, the rattle, the deep bait, the float bait, the near bait, a club and a spear... Deep bait, consisting of an old chicken or piece of pig was attached to a sennit rope and thrown overboard about 10 feet deep. A bait of pig, or the dried meat of a bonito head, was attached to a breadfruit wood float, and dragged a great distance--10 to 20 fathoms--behind the boat. The near bait, again of pig or the gills of a fish, was used in the final maneuvering of the shark into the noose. Once the shark was noosed, he was hit over the head with a club made of hard wood. Sharks that continued to fight were then gorged through the mouth and gills with a spear, also made of hard wood.

Severance reported that shark fishing could occur at any time of the year. During the months of January and February when storms are most frequent, the Samoans were reluctant to conduct this kind of fishing. Some expeditions stayed out only 1 day, while others might stay for as long as 7 days on the open sea. In addition to the *tiu malie* another method used to capture sharks described was *sasa,* similar to the former method except that the shark was speared when close to the boat. Both of these methods were reportedly still in use through the 1950s.

Ceremonial distribution of sharks that were caught during shark fishing expeditions is also described by Severance. After speeches and prayer, this included the cutting of the shark into specifically named parts and the distribution of the parts to prominent people in the village. Certain parts went to the village minister and to other ranking chiefs. If a large number of sharks were caught, some would be given to the wives of the chiefs or to the chiefs for further distribution.

Severance also reports on continuities in shark fishing from informants who described fishing expeditions aimed at sharks that continued into the late 1980s when the information was collected. In two such expeditions, sharks were presented and distributed according to Samoan custom as described above.

Sharks are still captured unintentionally by the domestic commercial longline fleet, both the smaller alias and the two larger domestic commercial longliners. Several Samoan vessel owners remarked how Samoans will still eat shark if it is offered; however, there is no commercial market for shark meat.[91] There didn't appear to be any universal like or dislike of sharks for food. Severance reported that according to one of his informants, the people from Ta'u like to eat sharks, while other informants described shark as a food preferred by older people.

From all of the above, several main points are evident. First, in spite of apparent contemporary knowledge of shark names in the Samoan language there is little description of specific shark species utilized in either historic or more recent accounts that would enable identification. Second, the importance of sharks as a non-commercial food source in Samoa is much more evident in historical and contemporary accounts than those from Hawaii. Third, the

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[91] Sharks that are caught incidentally to either bottomfishing or albacore longlining by artisanal boats in the former Western Samoa are commonly sold for food in the public fish market in Apia. The meat is most often cut into large chunks and sold fresh at prices less than more preferred bottomfish or trolled species such as skipjack or yellowfin tuna.

literature and interviews from Samoa failed to note any spiritual relationship as that of the *'aumakua* in Hawaiian culture.

10. IDENTIFICATION AND DISCUSSION OF MANAGEMENT ALTERNATIVES

There are currently no fishery regulations governing the taking or discarding of sharks in the U.S. EEZ within the jurisdiction of the Western Pacific Regional Fishery Management Council. In the absence of any fishery regulation governing sharks, the act of finning and discarding the carcass is an income maximizing activity undertaken by a vessel's crew, primarily for their benefit. Although finning is not aimed at maximizing profit of the vessel, it can be argued that owners in some fleets, particularly those paying a monthly wage, indirectly benefit by the ability to increase overall crew income at little or no expense to themselves.

There is no market for the vast majority of the sharks taken; and for those that are taken, in addition to the low ex-vessel price, the constraints of vessel configuration and capacity previously discussed play important roles in deciding whether or not to retain the shark carcass. It is important to remember that not only are sharks not a target of the fisheries discussed, but that fishing activities are not altered positively in response to the presence of sharks. That is, there is no attempt to catch more sharks and in fact if many are present there will be an attempt to move the vessel and reduce the interaction.

The concept of waste from a cultural or economic perspective is one that is far too large and complex to undertake during the current study. The former could involve not only the attitudes of indigenous cultures of Hawaii and the Pacific islands, but also the cultures and perspectives of owners, captains and crews employed on vessels, and the cultural attitudes of consumers and the public at large, including those who consume shark or shark products.

Economic perspectives on the issue of waste as represented by bycatch and discards are also complex and involved. For example, since the basis of most economic analyses is the concept of efficiency, the subject could be seen in the terms of keeping discards at an economically optimal level. Pasco (1997) has described this as taking into account the benefits produced in association with discarding; e.g., the catch of the target commercial species, and balances these with the costs in terms of the externalities produced. From this perspective, discarding could be compared with the generation of pollution in that both are unintended by-products of the production process.

As was shown in Section 5, the full use of the blue shark portion of the catch by Hawaii's longline fleet is not practical, given the fleet's current configuration among other factors. From a marketing standpoint, even if a means was found to allow the landing of large amounts of properly bled and iced blue shark within a few days of capture, the resultant value of the product on a world market basis would probably be less than the cost of landing it.[92]

The restrictions placed on managers in determining which, if any, appropriate measures might be instituted are defined by the Magnuson-Stevens Act, which states that fish harvested in a fishery, but not sold or kept for personal use, are bycatch. As the very issue of shark finning shows, by this definition sharks are currently not considered bycatch.

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[92] This includes the opportunity cost of not being able to land further target species in vessels that are capacity constrained.

While management decisions should be based on scientific facts relating to the biology of the animal in question, policy in the case of sharks (and particularly blue sharks) appears to be driven more by a public perception of finning as wasteful or cruel.

This perception has been heightened in recent months by public information campaigns in Hawaii, some of which are not aimed at highlighting fisheries management goals per se, but mix conservation goals with other issues such as animal welfare concerns over the purported, but inaccurate, finning of live sharks in Hawaii. There has also been some confusion on the source of fins entering commerce in Hawaii, juxtaposing references to those produced by high seas ULT vessels with those produced by domestic vessels. At least in partial response, management alternatives presented and discussed here are aimed mainly at curtailing the practice of finning, rather than being based on the impact of finning on either the fisheries population or the environment.

In this context, potential management actions discussed here range from retaining the status quo to a total prohibition on finning. The options include those two plus two others that have been utilized elsewhere in the U.S. EEZ or apply to U.S. vessels under an international management regime. A final consideration, one that would seek to minimize mortality and could be appended to all options, is also described.

While the discussion of management alternatives applies mainly to U.S. domestic vessels fishing in the U.S. EEZ, potential impacts on foreign fleets that might want to fish pursuant to Pacific Island Area Fishing Agreements (PIAFAs), or that call at ports in those areas for off-loading, transshipment, or resupply are also discussed.

10.1 Implications for Guam, the Northern Mariana Islands and American Samoa

For Guam, the Northern Mariana Islands, and American Samoa, if the intention of a prohibition on finning or requiring retention of the carcass was to regulate fishing activities by U.S. flag vessels, only a relatively few vessels would be affected, most of those being in American Samoa. If the management actions applied to foreign vessels seeking to fish in the U.S. EEZ, it would probably have a negative effect on the desire of foreign operators to pursue a PIAFA that would enable them to operate in any of these areas. Taiwanese in particular would probably not be willing to give up the finning option, as it provides income directly to the vessel owner in the case of Guam, and is an important part of crew compensation for vessels calling at American Samoa. The smaller Japanese vessels operating from Guam do not retain shark carcasses. They might be willing to consider operating in the EEZ without finning activities allowed, however other terms and conditions would probably be the determining factors, with a limitation on finning having an unknown but negative impact.

If the intention of prohibiting possession of shark fins without a corresponding carcass or whole shark aboard is also aimed at foreign vessels calling at Guam and American Samoa, the situation could be more complicated. For the Taiwanese in Guam, the decision on whether or not to relocate would be based on numerous factors. The inability to possess shark fins in the EEZ around Guam as is now the practice would be a strong negative factor, but not the only one. Others contributing to a decision whether or not to utilize Guam as an off-loading and resupply point would include catch rates in the intended fishing grounds, the cost of fishery access in those fishing grounds, transit time to port, and comparative operational costs such as air freight,

fuel, supplies and agency fees in Guam and elsewhere. All of these would have to be taken into consideration when alternative bases in FSM, Bali or General Santos are compared with Guam.

The decision could be more straightforward for the smaller Japanese vessels that call at Guam for transshipment. However, their government does not always share the same pragmatism as their fishing fleet when it comes to issues of fisheries management and trade. If there were any potential legal issues pertaining to the rights of fishermen to engage in trade while not actually fishing in the U.S. EEZ, the Japanese may be disposed to address those rather than arbitrarily give up any perceived rights.

It is difficult to say what the Taiwanese reaction would be to a prohibition on the possession of shark fins without the corresponding carcass if applied in American Samoa. While vessels need to off-load at the canneries, the elimination of the ability to market shark fins there for the crew's bonus might result in arrangements to off-load shark fins elsewhere or on the high seas. The most obvious location would be in Apia, less than 50 miles from American Samoa. Arrangements might also be made to sell to ULT refrigerated fish carriers on the high seas, or to other Taiwanese vessels returning to Taiwan.

10.2 Discussion of Management Alternatives

10.2.1 Retention of the Status Quo With No Action Taken

Under this option, there would be no change from the current situation, where there are no restrictions on:

- The finning of sharks.
- The weight of shark fins a vessel is allowed to land or possess.
- The manner in which a shark that is not retained is released.

10.2.1.1 Discussion

The percentage of sharks caught that were finned has increased each year in Hawaii since 1991 and there is no indication that a drop in prices for shark fins over the past two years has diminished the practice. Therefore, it can be assumed that finning would continue in the swordfish and tuna fisheries as fishermen seek to make the most profitable use of what they catch. The limiting factors would continue to be the number of sharks caught and the time and manpower available onboard to carry out the operation without adversely affecting other activities related to the capture and handling of target species.

It is not clear how a possible rise in the price of shark fins might affect finning activity. Information presented by Ito (1999a) showed a leveling off of the percentage of sharks finned by vessels undertaking swordfish and mixed target trips from 1997 to 1998 at about 50% of those captured. On the other hand, the percentage of shark catch finned by tuna-targeted trips continued to climb each year to about 85% in 1998. Should prices rise to pre-1998 levels, it is

probable that an even higher percentage of the sharks captured would be finned, surpassing the overall fleet-wide level of 57% in 1998.[93]

In strict economic terms, costs associated with finning would continue to be very small as long as owners and captains do not allow the practice to interfere with the catching and handling of the target species. In the case of blue sharks, there would continue to be no costs imposed on other fishermen through user conflicts, since there is no directed shark fishery aimed at this species.

There would be no increase in management costs to government with retention of the status quo. Costs could increase if the observer program were tasked with additional duties or if there were an increase in observer coverage aimed specifically at gathering greater information than is currently being collected on the catch and disposition of sharks.

10.2.2 Prohibition on Finning and Removing Fins at Sea if Destined for Sale or Trade

This option would prohibit the practice of finning in the U.S. EEZ in the western and central Pacific. It would be intended to apply to U.S. flag domestic vessels in the case of Hawaii. Shoreward of the outer boundary of the EEZ, it would be unlawful to sell, purchase, or deliver for commercial purposes, or possess on a U.S. flag fishing or receiving vessel any shark fin (including the caudal or "tail")[94] or portion thereof that has been removed from the carcass before the shark is brought ashore. Harvesters would be allowed to gut and bleed the carcass by making an incision at the base of the caudal peduncle as long as the caudal tail is not removed. Filleting of sharks at sea would be prohibited.

10.2.2.1 Discussion

A management action that requires the retention of a shark carcass in order to retain and sell the fins from that shark can be expected to have several consequences in the Hawaii longline fishery. It would eliminate or greatly reduce the landings of the greatest amount of shark fins currently produced, those from blue sharks. This is caused by the lack of an existing or potential market ashore as was described in Section 5 as well as the vessel configuration and capacity constraints explained. Because of these latter constraints it is probable that retained sharks would be from sets occurring near the conclusion of the voyage. In this manner, some blue sharks might be included in those retained for their fins, but a subsequent disposal problem could be created ashore for the unmarketable carcass.

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[93] The higher percentage finned may not mean more sharks captured, however. A shift away from swordfish targeting to tuna targeting trips may mean fewer sharks captured overall, since in 1998 the CPUE of blue sharks by tuna-targeted trips was only about one-tenth the CPUE experienced during swordfish targeted trips .

[94] In California where fins cannot be removed from the carcass until landing, an exception is made for thresher sharks. Tails and fins from thresher sharks can be removed as long as their original shape remains unaltered and a corresponding carcass is in possession for each tail and fin (California Fish and Game Code, Section 7704a). The reasons for this are presumably the more efficient bleeding that can be accomplished for threshers, a major market species, and the difficulty in storing a thresher aboard with the tail attached.

Because vessel crews and not vessel operators are the major recipients of the revenue from the sale of fins, there would seem to be little direct impact on the actual financial performance of the fleet. The most obvious impact would be in fewer shark fins being landed. This would result in a reduction or elimination of the estimated $1.6 to $1.8 million in direct economic contribution to the Hawaii economy that is calculated at current estimated shark fin prices.

It is possible that some Hawaii domestic longliners might want to avail themselves of the opportunity to market fins caught on the high seas through other arrangements that might develop. However, the degree of coordination that would entail, along with the likely distances involved and the relatively small value of fins available per trip, would make this scenario unlikely.

Depending upon the penalties attached, a prohibition on finning would require some policing or monitoring, particularly if demand and the price of fins significantly increased. If penalties were severe, a deterrent would probably be created that could reduce the need for policing.

Although discouraging the landing and retention of blue sharks, the incentive would still exist to land some mako and thresher sharks, as some value might be obtained from the meat as well as fins. Although the market elasticity of supply for shark meat in Hawaii is not fully known, it is thought that the amount that can be absorbed in the market is limited. This is evident by auction prices that have remained fairly constant for the past several years, and the relatively small percentage of both mako and thresher shark retained as compared to those caught: 35% of the mako and only 4% of the thresher were kept in 1998. Delivering larger numbers of these two species would probably either drive prices even lower than at present, or result in a disposal problem for carcasses ashore.

It is doubtful that a large number of blue sharks would be retained and landed ashore. However, some comments during recent legislature hearings inferred that there might be an unknown volume of sharks with no carcass value landed (Mustard, 1999). Whether or not adoption of this management option would result in this kind of response from fishermen is not known.

A further practical problem would confront vessel operators if, for some currently unknown market reasons, they were able to market a greater percentage of the mako and thresher taken. Storage of whole sharks with fins still attached does not allow for the optimum use of space in a fish hold. In severely capacity-constrained vessels, high grading (the practice of discarding lower value species to make space for higher valued ones) could be expected to occur.

The longliners that are occasionally employed to transfer fins from the tankers serving the high-seas ULT fleet are termed receiving vessels by NMFS. The inclusion of receiving vessels in this option would prohibit the transshipment of fins from high-seas (or any other) vessels operating outside the U.S. EEZ. From the discussion in Section 8 it can be assumed that prohibition of transshipment in this manner may hinder but most likely will not stop the marketing of fins from the high seas ULT fleet currently utilizing Hawaii as a transshipment point.

The prohibition of filleting sharks at sea would be required to enable accurate matching between carcasses and fins. Although not a major concern at present, this will preclude any future efforts to more efficiently store sharks onboard or better market certain shark species through improved handling and freezing, should vessels be equipped to do so[95].

10.2.3 Requirement that Fins Removed at Sea and Landed for Sale or Trade Must Be Landed in Appropriate Proportion to the Quantity of Carcasses Also Landed.

The practice of finning would be prohibited in the EEZ of the western and central Pacific. Shoreward of the outer boundary of the EEZ it would be unlawful to posses shark fins, carcasses, or other parts onboard or off-load shark fins from a fishing or receiving vessel except as specified as follows:

- Option (1): Shark fins that are possessed onboard or off-loaded from a fishing vessel must be in proper proportion to the weight of dressed carcasses. That is, the wet weight of fins may not exceed 5% of the weight of the dressed carcasses. A carcass is defined as a shark with the internal organs, head, and fins removed.
- Option (2): Shark fins may be possessed onboard or off-loaded from a fishing vessel if the corresponding carcass is in possession for each set of fins retained.

Under either option (1) or (2), fins would not be stored onboard the vessel after associated carcasses were sold, traded or bartered and must be weighed and monitored at the time of landing. Filleting of sharks at sea is prohibited.

10.2.3.1 Discussion

Option 3 (1) is currently used in the mainland for the directed shark fishery. In that instance controversy was created by arguments over the manner in which carcasses are dressed and the various measurements applicable dressed carcasses of different species, wet fin weight to dried fin weight of various species, and a host of other problems discussed in Section 6. This problem may be made more difficult to solve because existing conversion factors, while still contentious, were adopted for the Atlantic and may not be totally applicable in the Pacific. No detailed research work is known to have been undertaken in the Pacific on all species of sharks captured by longline fisheries in the central and western Pacific.[96] These arguments may be significant because of the high value to weight attribute of shark fins.

Monitoring of landings would be time consuming as both fins and carcasses would have to be weighed. If fins and carcasses were sold to separate buyers as assumed would be the case, a certain amount of coordination to ensure that both were weighed at the same time and appropriate documentation would be required.

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[95]The practice of steaking is also sometimes utilized in onboard processing. Any prohibition on filleting would have to include steaking as well.

[96] Ito (1997) reported that the average whole weight of blue shark was estimated from observer data collected during 1990-1991.

The second option, that of requiring a carcass be landed for each set of fins eliminates some of the problems in the first option.[97] It also removes some of the monitoring tasks as no weights would be required at the time of landing, although monitoring would be required. While it would be possible to substitute smaller shark carcasses for larger ones (to save on storage space and limit ice loss), the added work involved in finning two sharks to obtain the fins of one would probably deter this practice. Those officials monitoring the landings may have to learn the morphometric characteristics of the most common shark species caught and be able to recognize the substitution of different species of carcasses or sizes of the same carcasses. This would be more difficult if fins were dried and no physical identification system employed to match carcasses with fins.

10.2.4 Imposition of a weight limit

The practice of finning would be allowed in the EEZ of the western and central Pacific subject to a weight limit. The weight limit would apply for a person who fishes or possesses a shark fin in the EEZ. The weight limit for all shark management unit species combined is ___ kg of fins per vessel per trip. There would be no transfer at sea of fins from a shark taken in the EEZ, regardless of where such transfer takes place, or where a shark was taken.

10.2.4.1 Discussion

This option would establish a precautionary catch level, although not on an individual species basis. Since such a level would logically be based on whole weight of sharks with fin weight being the surrogate measure, the same problems associated with determining conversion factors would apply. Although not insurmountable, some research would be required to provide a reasonably accurate set of conversion factors to eliminate problems such as those described earlier. Conversion factors of dry to wet fins would also be required should vessels retain them in the latter condition.

Once a reasonable set of conversion factors was determined, the actual catch level, either in terms of numbers of sharks or weight would have to be set. Depending on the level of quota established, such a system could result in the high grading of sharks during a trip. There would also be problems in differences in the duration of "a trip" as it applied to the target species, including trips with mixed targets, that would have to be taken into consideration. Other problems in setting such a quota would relate to allocations in the event that the overall fleet size increases or decreases.

This option would also require a certain amount of record-keeping and monitoring to insure compliance.

10.2.5 Minimization of Mortality

A shark that is harvested in the EEZ of the central and western Pacific that is not retained must be released in a manner that will ensure maximum probability of survival.

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[97] From a practical point of view, the upper caudal with no value could be discarded at sea.

10.2.5.1 Discussion

This option is actually one that could be appended to any of the above four options. Since "retained" includes the retention of the fins, from a conservation standpoint its overall effect is unknown, since the number of sharks killed but not finned is also not known.

The manner of releasing is left to discretion, with the most likely being that the leader would simply be cut. Anecdotal evidence suggests that sharks are captured with old hooks still attached (J. Arceneaux, pers. commun.), so presumably allowing the hook to remain would not adversely affect the chances of survival.[98] It is possible that a "de-hooking tool" could be employed to retrieve hooks in some situations and thereby reduce the cost of lost hooks. One such tool costing about $150 is known to be used on the U.S. east coast in some fisheries, however its suitability and effectiveness in the Hawaii situation is not known.

10.3 Monitoring and Record Keeping

Any of the three management actions that limit the amount of shark fins taken or finning that takes place will require some monitoring[99]. The commodity's value, its relative ease of storage and the continued demand for the product could discourage compliance unless penalties were large enough to act as a strong deterrent.

In 1997 the Hawaii longline fleet completed about 1,100 trips, and it is assumed that there were no major changes in fleet numbers or structure for 1998. The NMFS logbook summary for 1998 released in February, 1999 shows catches of blue sharks in all four quarters of the year, with the mean catch in numbers by quarter for the years 1994-1998 varying very little. This indicates that any monitoring for compliance with any of the management options limiting shark catch would have to be conducted on a year-round basis. Certain peak periods, such as when tuna longliners make as many trips as possible during the winter holiday season, would have to be taken into consideration.

The greatest level of monitoring would be required by the management actions that require fins to be landed in proportion to the quantity of carcasses. The least would probably be in connection with a management action requiring retained sharks to be landed with the fins intact.

Additional considerations would have to be given to monitoring commercial fishing activities in the state that might produce shark fins which do not utilize Honolulu as a landing site. These may include the seamount fishery and bottomfishing activities as well as longlining based elsewhere.

No dollar estimates of the cost of monitoring and record-keeping are made here, as detailed costs of any monitoring program would involve the administrative arrangements

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[98] This comment refers to hooks in the jaw or mouth of sharks, not those that may be ingested.

[99] Monitoring here is seen to be separate from enforcement, with the former a verifying function taking place usually at the time of landing and the latter conducted at any time by appropriately designated enforcement officers.

adopted for each. These could range from voluntary compliance and reporting with spot checks as the least cost option, with full monitoring of each off-loading incurring the highest cost.

Once determined, the costs of monitoring and enforcement would have to be added to other external costs created by whatever management decision is taken to determine the overall costs and benefits of implementation. These externalities could include a wide range of costs, including those generated by the fishery and the loss of social benefits. This latter element includes any special value or "passive use value" that society may attach to the species.[100]

10.4 Developing More Selective Longline Fishing Gear

The main causes of incidental catch of sharks in the longline fishery are sharks occupying the same habitat as the target species and their opportunistic feeding patterns. Overall, a longline employed to target a particular species such as bigeye tuna exhibits more selectivity than, say, a trawl or gill net. Still, there are species other than tuna that are caught by longline. There has been little incentive in longline fisheries in general and Hawaii in particular to develop more selective gear with respect to sharks, probably because until fairly recently there has been no perceived problem with the capture of sharks. As an essentially unregulated fishery, there has been no demand for gear technologists to apply their skills to the situation. A greater emphasis on the development of species-specific longline gear or that which might discourage sharks from attacking the baits would seem to be warranted.

In addition to developing more selective gear, in the short term there is a need to investigate mitigation measures aimed at reducing the number of sharks that are captured that would focus on refinement of the existing fishing gear. Some candidates for research could be the color, placement and frequency of lightsticks used in the swordfish fishery, the exclusive use of monofilament leaders in the tuna fishery, and the types of hooks used in both. There may be existing electronic equipment, such as the "down temp" temperature and depth sensor that has been used in the east coast longline swordfish fleet, that may be applicable to Hawaii-based vessels to help avoid areas where environmental conditions would have a greater tendency to congregate sharks. It is important that the investigation of mitigation measures and gear selectivity keep in mind the technical efficiency of the existing gear, and not impose additional costs on fishermen by reducing that efficiency.

10.5 Consideration of Other Fisheries

This study has addressed longline and purse seine fisheries in the central and western Pacific. There are, however, other fleets that may capture sharks incidentally to their fishing operations that may need to be considered in the application of management actions regulating sharks.

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[100] It is clear, at least in the Hawaii situation, that sharks do have a special value to segments of society, and that this value may not have anything to do with the impact of fishing on the existence of the species.

10.5.1 Hawaii

In Hawaii, the largest commercial fishing components potentially affected would be the bottomfishing vessels, including those that fish in more distant locations such as the northwestern Hawaiian Islands, and Kingman Reef and Palmyra. Anecdotal information suggests that at least some bottomfishing vessels engage in shark finning activities on an opportunistic basis. Vessels engaged in the seamount fishery for yellowfin and bigeye also must be considered, although it is not clear if they are engaged in finning to any extent.

10.5.2 Guam

In January, 1999 there were no U.S. registered longliners comparable to the Japanese and Taiwanese longliners operating from Guam. The typical domestic vessel is an artisanal owner-operated, 18 to 30 ft trolling boat, powered by outboard, inboard-outboard, or diesel inboard engines, carrying one or two crew members. There are also about 20 sportfishing charter boats on Guam. According to the Guam Fishermen's Cooperative, there were only four or five full-time fishermen active in the Coop out of a total 160 members (M. Duenas, pers. commun.). Both full-time and part-time trollers reported extreme predation by sharks in schools of yellowfin, particularly those found near the offshore banks, but there was no reported shark capture or finning activity undertaken by those fishermen. In fact, very few sharks are intentionally taken by the artisanal vessels on Guam, with the previously mentioned lack of a market for shark meat there being the primary reason.[101]

10.5.3 Northern Mariana Islands

In the Northern Mariana Islands, there is a small bottomfishing fleet based in Saipan of about four to six vessels that fish in the northern islands, although only two were operational in January, 1999. The vessels take trips lasting from 3 to 7 days or longer to islands north of Saipan. Crew members on the currently active vessels are mostly Filipinos. The operator of one of the vessels described predation by sharks on hooked bottomfish as a major problem. The reported response of fishermen is to attempt to kill the sharks or move if predation continues. There apparently is no finning involved.

10.5.4 American Samoa

In American Samoa, there are only two commercial vessels over 60 feet in length engaged in longlining, although five others held permits as of February, 1999.[102] The total number of sharks finned in 1998 was 325, according to the NMFS logbook summary provided the Council on February 4, 1999. These could have come from either the two larger vessels, or the growing fleet of alias that numbered over 30. During interviews with the two operators of the

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[101] The president of the Co-op stated that while captured sharks could be given away for food, they had tried marketing shark on occasion, but could not sell it.

[102] These are described by NMFS as vessels from the mainland or Hawaii who hold American Samoa general permits and may not be longliners.

larger active vessels they made it clear that finning was not a major activity onboard their vessels.

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11. REFERENCES

Aluli, N. E. (1999). Written testimony of Noa Emmett Aluli, M.D., Chairperson of the Kaho'olawe Island Reserve Commission presented to the Hawaii State Legislature Senate Committee on Water, Land and Hawaiian Affairs, on HB 1706, HD3, SD1. April 5, 1999.

Anon. (1981). A report on the development of the Pacific blue shark as a commercial fishery. W. Coast Fishery Development Foundation, NOAA Contract No. 80-ABH—00052.

Anon. (1982). Shark control and market development program final report (Saipan). Pacific Fisheries Development Foundation, Honolulu. 7 p.

Anon. (1996). Value of fish transshipment on Guam. Information paper presented at 91st Western Pacific Fishery Council Meeting, November 18-21, 1996, Honolulu, 4 p.

Anon. (1998). Pelagic fisheries of the western Pacific region: 1997 annual report, draft 10/15/98, prepared by the Pelagics Plan Team and Council staff, Western Pacific Regional Fishery Management Council, Honolulu.

Anon. (1999). Testimony to the Committee on Economic Development presented by Bill Mustard, Boat Owners Association of the State of Hawaii, attachment 8. March. 24, 1999.

Arai, K. and T. Kunimaki (1987). Nutritive values of protein and lipids of shark meats ("Sameniku dasshi miru no tanpakushitsu oyobi chushutsu kinniku shishitsu no eiyoka"). Bulletin of the Tokai Regional Fisheries Resource Laboratory, no. 122, in Japanese with abstract in English. 4 p.

Bailey, Kevin, et al. (1996). By-catch and discards in western Pacific tuna fisheries: a review of SPC data holdings and literature. Technical report No. 34, Oceanic Fisheries Programme, South Pacific Commission, Noumea

Bentley, Nakome (1996). Australia overview, in: The world trade in sharks, a compendium of TRAFFIC's regional studies, vol. II. TRAFFIC, Cambridge. 88 p.

Bonfil, Ramon (1994). Overview of world elasmobranch fisheries. FAO Fisheries technical paper 341. Food and Agriculture Organization of the United Nations, Rome. 118 p.

Cheu, N. (1999). Letter to the Committee on Water, Land and Hawaiian Affairs opposing House Bill 1706 HD3, SD1, April 5, 1999.

Clemens, Jon (1997). American Samoa preliminary sharkfin report. Department of Marine and Wildlife Resources. Unpublished notes. 4 p.

Coan, A. L, Jr., R. Ito and B. Kikkawa (1998a). U.S. fisheries for tropical tunas and billfish of the central-western Pacific and South Pacific albacore, 1993-1997. Working document for the 11th Standing Committee on Tuna and Billfish, Honolulu, May, 1998. 21 p.

Coan, A. L, Jr., G. Sakagawa, D. Prescott, G. Yamasaki (1998b). A review of the 1997 U.S. purse seine fishery for tropical tunas in the central-western Pacific Ocean. Document prepared for the annual meeting of parties to the South Pacific Regional Tuna Treaty, 30 March – 3 April, 1998. Southwest Region, NMFS. La Jolla

Coan, A.L., G. Sakagawa, D. Prescott, P. Williams, and G. Yamasaki (1999). The 1998 U.S. tropical tuna purse seine fishery in the central-western Pacific ocean. Document prepared for the annual meeting of parties to the South Pacific Regional Tuna Treaty, 24-30 March, 1999. Southwest Region, NMFS La Jolla.

Fong, Q.S.W. and J.L. Anderson (1998 in press). Assessment of Hong Kong shark fin trade. Department of Environmental and Natural Resource Economics, University of Rhode Island, Kingston, 9 p.

Gillett, R.D. and M. McCoy (1997). Employment of Pacific islanders aboard foreign fishing vessels. Forum Fisheries Agency, Honiara. 100 p.

Graham, T. (in prep.). Palau's locally based foreign tuna fishery: benefits and costs to Palau. January, 1999 draft. Palau Conservation Society. Koror. 68 p.

Hamilton, Marcia S., R. Curtis, and M. Travis (1996). Cost-earnings study of the Hawaii-based domestic longline fleet. JIMAR Contribution 96-300. Joint Institute for Marine and Atmospheric Research. Honolulu. 59 p.

Hamnett, Michael P. and S. Pintz (1996). The contribution of tuna fishing and transshipment to the economies of American Samoa, the Commonwealth of the Northern Mariana Islands, and Guam. SOEST 96-05, Pelagic Fisheries Research Program, University of Hawaii, Honolulu. 38p.

Hezel, F.X. and M. Levin (1996). New trends in Micronesian migration: FSM migration to Guam and the Marianas. In Micronesian migration since World War II, Micronesian Counselor, August, 1996. Micronesian Seminar, Pohnpei. P.20-33.

Holts, D.B., A. Julian, O. Sosa-Nishizaki, N. Bartoo (1998). Pelagic shark fisheries along the west coast of the United States and Baja California, Mexico. In the journal Fisheries Research, 39 (1998) p. 115-125.

Ito, Russell Y. and W. Machado (1997). Annual report of the Hawaii-based longline fishery for 1996. NMFS Honolulu Laboratory, Southwest Fisheries Center, Administrative report H-97-12, 48 p.

Ito, Russell Y. (1999a). Percent of shark catch processed by trip type. Plots and graphs dated April 8, 1999 and presented to the Pelagics Advisory Panel of the Western Pacific Regional Fishery Management Council, April 14, 1999, Honolulu.

Ito, Russell Y. (1999b). Annual report on the western Pacific longline fisheries, 1997-98. NMFS Honolulu Laboratory, Southwest Fisheries Center, Administrative report (forthcoming).

Jeng, S. and Deng Fwu Hwang (1978). Study on the use of small sharks for fish ball production. (in Chinese with abstract in English). Journal of the fisheries society of Taiwan, vol. 6 number 2, 1978 10 p.

Keanaaina, Kani K. (1999). Written testimony presented to the Hawaii State Legislature Committee on Water, Land and Hawaiian Affairs on HB 1706. April 2, 1999.

Kiyono, H. (1996). TRAFFIC report on shark fisheries and trade in Japan. In Phipps, M.J. (Comp.), TRAFFIC (East Asia) report on shark fisheries and trade in the East Asian region. TRAFFIC East Asia, Taipei.

Lai, E. K. (1983). Shark fin processing and marketing in Hong Kong. Infofish Marketing Digest, No. 5/83. Infofish, Kuala Lumpur, 4 p.

Lawson, T.A. (1997a). Estimation of bycatch and discards in central and western Pacific tuna fisheries: preliminary results. Oceanic Fisheries Programme Internal Report No. 33, South Pacific Commission, Noumea, 30 p.

Lawson, T.A. (1997b). Review of catch estimates for Taiwanese distant-water longliners. Oceanic Fisheries Programme Internal Report No. 31, South Pacific Commission, Noumea, 19 p.

Lee, J.K (1998). The Korean tuna industry situation and outlook. in Tuna 97 Bangkok, papers of the 5th World Tuna Trade Conference, 25-27 October, 1997. Infofish, Kuala Lumpur, 4 p.

Lightfoot, Chris and C. Friberg (1997). Albacore freezer longline fishery: situation report and economic analysis. Report prepared for FFA, Honiara 51 p.

Lightfoot, Chris and C. Friberg (1998) The frozen sashimi longline fishery: likely profitability and potential development opportunities for Pacific island countries. Report prepared for FFA, Honiara. 51 p.

McCoy, M.A. (1998). Distant water tuna purse seine fleets in the western Pacific: current trends and future outlook, in Toward a prosperous Pacific: building a sustainable tuna industry in the Pacific Islands, D. Zachary, C. Sterling and L. Karolat, eds., Maui Pacific Center, Maui. 8 p.

McCoy, M.A. and R. Gillett (1998). Foreign tuna purse seining in the Pacific islands: the current situation and business opportunities. Report prepared for the Forum Fisheries Agency, Honiara. 95 p.

Mustard, W. (1999). Letter to Committee on Water, Land and Hawaiian Affairs opposing HB 1706, HD3, SD1 dated April 5, 1999.

NMFS (1999). 1998 Preliminary longline logbook summary report, presented to Western Pacific Regional Fishery Management Council, February 24, 1999. NMFS Honolulu Laboratory.

Otwell, W., F. J. Lawlor III, J. A. Fisher, G. H. Burgess, Jr., F. J. Prochaska, and J. M. Stevely. (1985). Manual on shark fishing. Florida Sea Grant Report No. 73. Florida Sea Grant College.

Pan, Lynn, ed. (1998), The Encyclopedia of the Chinese Overseas, Archipelago Press, Singapore.

Parry-Jones, R. (1996). TRAFFIC report on shark fisheries and trade in Hong Kong. In: Phipps, M.J. (Comp.) TRAFFIC East Asia report on shark fisheries and trade in the east Asia region. TRAFFIC-East Asia, Taipei.

Park, Y., W. Yang, and T. Kim (1991). Status of Korean Tuna Longline and Purse Seine Fisheries in the Pacific Ocean. Background Paper 17, FAO Expert Consultation on Interactions of Pacific Tuna Fisheries, FAO, Suva.

Park, Yeong-Chull (1998a). On-board scientific trip for Korean tuna fishery. Paper presented to eleventh meeting of the Standing Committee on Tuna and Billfish, 26 May-6 June 1998, Honolulu, 6 p.

Park, Yeong-Chull (1998b). Korean tuna fisheries in the western Pacific ocean. Paper presented to eleventh meeting of the Standing Committee on Tuna and Billfish, 26 May-6 June 1998, Honolulu, 9 p.

Pascoe, S. (1997). Bycatch management and the economics of discarding. FAO Fisheries Technical Paper No. 370. Rome, 137 p.

Reipen, M. (1987). Distant Water Tuna Longline Fishery, in D. Doulman, Tuna Issues and Perspectives in the Pacific Islands Region. East-West Center, Honolulu. Pages 161- 173.

Rose, D.A. (1996). An overview of world trade in sharks and other cartilaginous fishes. TRAFFIC International, 106 p.

Severance, Craig J. and R. Franco (1989). Justification and design of limited entry alternatives for the offshore fisheries of American Samoa, and an examination of preferential fishing rights for native people of American Samoa within a limited entry context. Report submitted to Western Pacific Regional Fishery Management Council, Honolulu. 71 p.

Sonu, Sunee C. (1998). Shark fisheries, trade and market of Japan. NOAA Technical Memorandum, NOAA-TM-NMFS-SWR-033, October, 1998. 70 p.

South Pacific Commission (1998). Tuna fishery yearbook 1997. T. Lawson (ed.). Noumea, 104p.

Taiwan Fisheries Bureau (1996). Fisheries yearbook, Taiwan area 1995. Department of Agriculture and Forestry, Provincial government of Taiwan. Taipei., 369 p.

Taiwan Fisheries Bureau (1998). Fisheries yearbook, Taiwan area 1997. Department of Agriculture and Forestry, Provincial government of Taiwan. Taipei, 381 p.

Tavel, Ltd. and Dept. of Fisheries and Oceans (1995). Guidelines for the onboard handling and onshore processing of blue shark.. Pamphlet prepared for Blue Shark Consortium Cooperative Association, Halifax, Nova Scotia. 31 p.

Taylor, Leighton (1993). Sharks of Hawaii, their biology and cultural significance. University of Hawaii Press, 126 p.

Travis, Michael D. (1999). Entry and exit in Hawaii's longline fishery, 1988-96: A preliminary view of explanatory factors. In Chakravorty, U. and John Sibert, Ocean-scale management of pelagic fisheries: economic and regulatory issues, proceedings of an international workshop organized by the Pelagic Fisheries Research Program, JIMAR, University of Hawaii, 12-13 November 1997. JIMAR contribution 99-321. Honolulu.

Wass, Richard C. (1984). An annotated checklist of the fishes of Samoa. NOAA Technical Report SSRF-781. National Marine Fisheries Service.

Williams, P.G. (1996). An update of by-catch issues in the western and central Pacific Ocean tuna fisheries. Paper presented at the Asia-Pacific Fisheries Commission (APFIC) symposium on environmental aspects of responsible fisheries, Seoul Korea, 15-18 October. Oceanic Fisheries Program, Noumea. 14 p.

Williams, P.G. (1997). Shark and related species catch in tuna fisheries of the tropical western and central Pacific Ocean. Paper produced for FAO meeting of the Technical Working group on Sharks, Tokyo, 23-27 April 1998. South Pacific Commission, Noumea, 23 p.

Wong, C. (1999). Written testimony to the Committee on Water, Land, and Hawaiian Affairs regarding legislative bill HB 1706 HD3 SD1, April, 1999. Honolulu.

WPRFMC (1999). Shark timeline. Information paper provided to the Pelagics Advisory Panel, Western Pacific Regional Fishery Management Council, Honolulu. 16 p.